N.YOIRISH

CURATIVE PROPERTIES OF HONEY AND BEE VENOM

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Moscow 1959

Translated from the Russian by Xenia Danko
Edited by David Skvirsky

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Our most precious possession, the greatest riches of our country are our Soviet people. The preservation of the people's health, of their working ability is, therefore, one of the noblest callings.

Mikhail Kalinin

FOREWORD

For many centuries, honey has been regarded as a wonderful gift of nature in which the properties of an excellent food, beneficial alike to adults and children, are combined with medicinal properties. Ancient Russian manuscript medical books attached great importance to honey as a medicine. Popular medicine has successfully used it for many diseases from time immemorial. The results of experiments and observations made by the medical science in recent decades have proved that honey is an important medicine possessing many-sided therapeutic properties.

Honey is very effective in the treatment of some pathological conditions of the intestinal tract, the respiratory organs, the heart, and the nerves.

Basing his experiments on the teachings of Ivan Michurin and Ivan Pavlov, this author has obtained 85 new kinds of therapeutic and vitaminic honey, thereby proving that bees can be made to produce honey of a desired chemical and biological composition at any season.

The knowledge that bee venom possesses medicinal properties has come down to us from remote antiquity. Written evidence, as well as the observations of many beekeepers and our own long experience, confirm the effec-

tiveness of bee venom in the treatment of rheumatic fever, neuritis and some other diseases.

Beeswax is a valuable product for the preparation of various ointments and plasters, and is also an important raw material for many industries.

Furthermore, bees produce propolis, or bee glue, which is used in popular medicine for wounds and some diseases.

The role played by bees in effecting cross-pollination of insect-pollinated plants cannot be overestimated.

Beekeeping is a pleasant and remunerative occupation for people who are unfit for hard physical work. It is particularly beneficial for high-strung individuals, as the work is done in the open air filled with the scent of flowers, honey, wax and propolis.

In addition, the interesting and absorbing work of beekeeping is an excellent method of occupational therapy.

In the U.S.S.R., beekeeping is practised on a large scale at collective and state farms and privately.

Hospitals, health resorts and other medical institutions cannot be advised too strongly to keep bees in order to include honey in the diet of their patients.

A biology teacher, especially in a rural locality, would do well to have an observation hive. The author hopes and trusts that this book will arouse in medical workers an interest in the application of honey and bee venom for therapeutic purposes and will help to promote medicinal apiculture.

Honey and bee-venom treatment must be carried on under the supervision of a physician and can be made a component part in a complex of curative measures for many diseases.

All criticism of this book will be accepted gratefully by the author and will be taken into account in his further work.

N. Yoirish

INTRODUCTION

Russia has always been famous for the high level of apiculture and was known in olden times as "the land of honey." We know from history that beekeeping was a flourishing industry in Russia and that takes were usually very good. Nestor, the first Russian historian (1056-1114), says in his chronicles that in the 10th century beekeeping was widespread in Russia and that honey was a major item of export.

The historian Paolo Giovio of Novum Comum (1483-1552) wrote in 1525 that in Muscovy "the best harvest is gathered of wax and honey. For the whole country is full of very productive bees which yield honey of great excellence."

Adam Olearii noted in his detailed record of the travels of the Holstein envoys to Muscovy in 1633, 1636 and 1639 that "honey and wax are to be found in the forests in such abundance that in addition to brewing mead from the former and making candles from the latter, the Russians ... sell great quantities of the surplus to other countries."

A favourable climate and an abundance of honey-yielding plants have made beekeeping an important branch of the country's national economy. Skilled practical beekeepers, such as P. Prokopovich, V. Vashchenko, M. Dernov, and such scientists-apiculturists as A. Butlerov, N. Kulagin, I. Kablukov and G. Kozhevnikov, have done much to develop rational beekeeping.

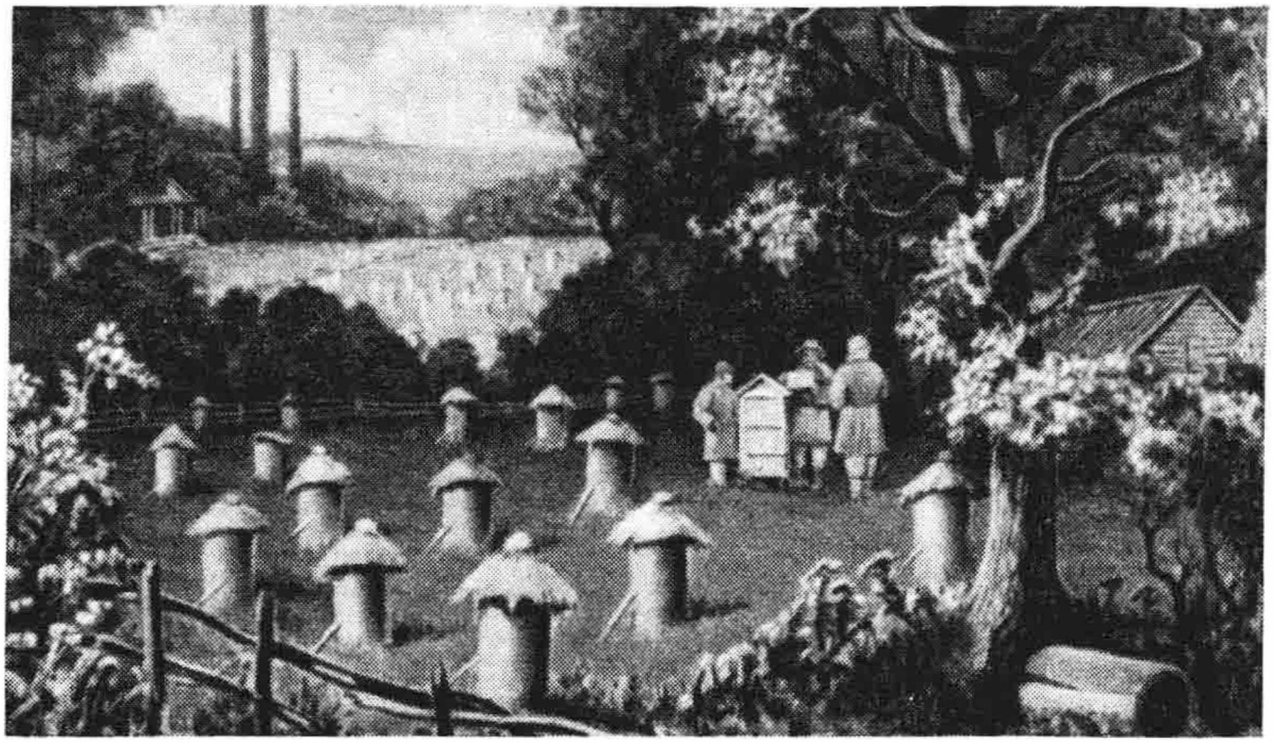

Fig. 1. The first movable-frame hive in Russia

P. Prokopovich (1775-1850) is remembered with gratitude by beekeepers for inventing (in 1814) the movable-frame hive. The apiary he set up in the Ukraine was the biggest and the best conducted in its time, and beekeepers came to him from all parts of Russia and from abroad to study advanced methods of beekeeping. In 1828, he founded at his apiary a school of beekeeping, the first in Russia and in Europe.

Notwithstanding considerable progress, beekeeping in tsarist Russia could not attain its maximum development: in 1910 there were 5,715,000 bee colonies in the whole of Russia, and of these, only a fifth were kept in frame hives. This important branch of agriculture suffered a set-back during World War I and the Civil War.

The October Revolution cleared the way for beekeeping. One of the Government's measures was the decision "On the Protection of Beekeeping," which Lenin signed on April 11, 1919. The decision stimulated the development of apiculture.

The setting-up of collective and state farms ensured further progress in beekeeping, and by 1940 there were in the Soviet Union more than 100,000 collective-farm apiaries with 10 million bee colonies; the country became the world's biggest producer of honey. The Nazi barbarians looted thousands of apiaries at collective and state farms and destroyed over 2,000,000 bee colonies.

Today, the Soviet Union again holds first place in the world as regards the number of bee colonies and record harvests of honey.

Honey is not only a tasteful and nourishing food, but owing to its complex chemical and physical composition it can be successfully used as a medicine against various diseases. It increases the resistance to infection in children and, unlike other medicines, they take it willingly.

Bee venom, too, is a medicine known from ancient times. People have long been aware that it is effective in the treatment of rheumatic diseases. This has been corroborated by examples from books, the evidence of numerous apiarists and our own observations. But rheumatic fever is not the only disease effectively treated by bee venom—it is equally effective in the treatment of neuralgia, neuritis and some other diseases.

Chapter I

GENERAL DATA ON BEE BIOLOGY

SOME ANATOMIC AND PHYSIOLOGICAL PECULIARITIES AND BIOLOGICAL FUNCTIONS OF MEMBERS OF THE BEE COLONY

Honey-bees are social insects, that is, they can live only in big colonies. Each hive is inhabited by one colony of bees, whose characteristic feature is polymorphism: there are the queen, the drones and the worker-bees. A colony is composed of one queen, a few hundred drones (male bees) and several tens of thousands (up to 100,000 and more) of workers (Fig. 2).

A queen is almost twice as long and 2.8 times as heavy as a worker-bee. Her biological function is reproduction; every day a queen lays into cells from 1,000 to 2,000 (and more) fertilized eggs. Out of these eggs hatch either queens or workers, depending on the composition of the brood food and the size of cells. A queen also lays unfertilized eggs, and out of these only drones hatch. Thus, we see that parthenogenesis, of which Aristotle spoke in his *History of Animals*, perseveres in the bee colony.*

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* Under certain conditions, such as the loss of the queen and absence of larvae from which a new queen could be bred, or an excess of worker-bees and scarcity of larvae, worker-bees, too, lay eggs in cells, but from such eggs only drones develop. In her lifetime, a worker-bee is capable of laying about 28 eggs. A queenless colony is doomed to extinction, because, in the absence of a queen, the colony grows only in terms of drones, which cannot do any work.

The queen's role in reproduction is confined to the laying of eggs. She may be said to be a living egg-laying machine. Workers, who feed the queen with a special "royal jelly," play a substantial part in increasing her laying capacity.*

The queen is a very important member of the bee colony. As soon as a colony consisting of many thousands of bees loses its queen, it begins behaving in a way that cannot fail to attract the beekeeper's attention: the workers run all over the hive with a peculiar booming sound. A colony cannot live long without a queen, so the workers select an egg or several eggs about three or four days old and start breeding a new queen. A pearly-white cylindrical egg (which later becomes a larva) is placed in a spacious "cradle," an acorn-shaped queen cell, where it receives royal jelly; these special conditions lead to the hatching of a young queen after sixteen days.

The queen's sting is her ovipositor and weapon of defence, which, however, she never uses against man, even if he hurts her (for instance, when the beekeeper clips a queen's wings); she never so much as protrudes it. But when a queen meets a rival queen she instantly attacks her with her sting.

The average life-span of a queen is 5 to 6 years, but as she grows older she becomes less prolific, and queens should therefore be changed after one or two seasons of egg-laying.

The drone's only function is to mate with the queen. Like the queen, the drone cannot procure food and in this

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* Royal jelly is a secretion of the worker's maxillary glands and contains proteins, fats, sugars, mineral salts, vitamins (B_1 [aneurin], B_2 [riboflavin], B_3 [pantothenic acid], B_5 [PP—nicotinic acid], B_6 [pyridoxine], B_c [folic acid], H [biotin], and, especially, E [the vitamin of reproduction]). In addition, royal jelly contains substances with the properties of the gonadotropic hormone, stimulating the maturing of the eggs in the queen's sex organs, and also germicidin, an antibiotic inhibiting the development of moulds and microbes.

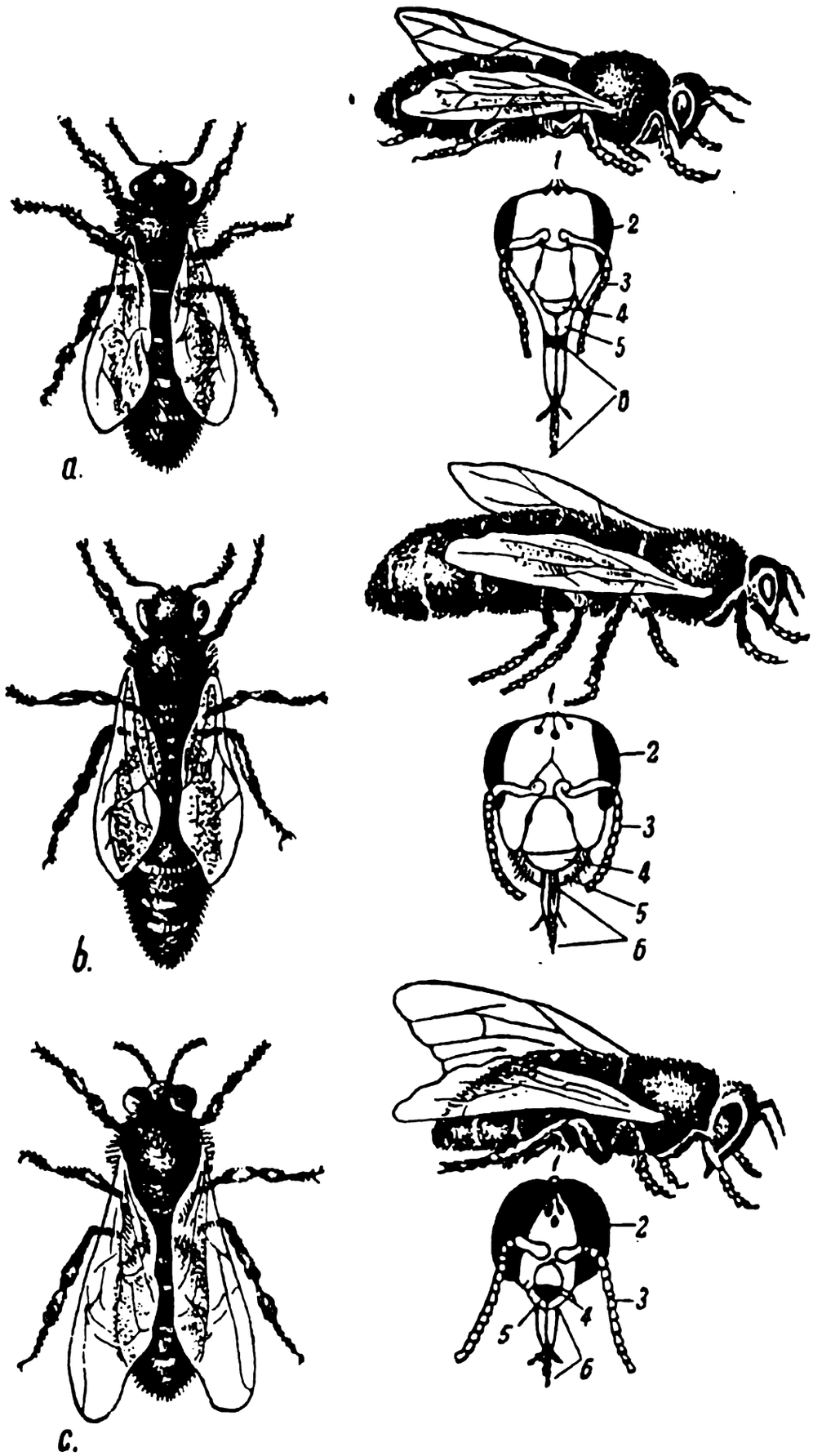

Fig. 2. The three castes of honey-bees (left). Right: schemes of their heads a. Worker; b. Queen; c. Drone. 1. Simple eyes or ocelli; 2. Compound eye; 3. Antenna, or feeler; 4. Labrum (upper lip); 5. Mandible; 6. Proboscis

respect he is entirely dependent on the workers. Drones spend the spring and summer eating the honey the industrious workers have made, but in the autumn they are expelled from the hive and die of cold and hunger.

Academician A. Butlerov writes: "Drones are males. They perform no work whatever, but at midday when the weather is fine they take their 'play flights.' They chase virgin queens and mate with them."

The average hatching time for drones is 24 days. The drone's sex organs (two testes, two vasa deferentia enlarging into two seminal vesicles, two epididymides opening into the ejaculatory duct, and the penis) are very well developed.

Spermatozoa mature in a drone on the eighth to fourteenth day after his emergence from the cell; the testes contain from 10 to 200 million spermatozoa.

The drone has excellent eyesight, which is very important during the mating flight, when he must pursue the queen at a high speed. Drones live in summer only, altogether about three months.

The worker-bee spends her short life in incessant work which is exceptionally useful for man. On the third or fourth day after birth, young bees start upon the very important duty of feeding the brood. During the six days in which they feed their future sisters, they visit each larva about 7,850 times.

Worker-bees show especial solicitude for the queen, who never leaves the dark hive after her mating flight. The bees of the queen's retinue clean her body, comb the hairs on it, take away her faeces, feed her with the highly calorific and nourishing royal jelly, and do many other services.

Workers fly in search of sources of nectar, pollen and water. They collect large quantities of pollen, wet it with their saliva mixed with nectar and carry it home in special "pollen baskets" on their hind legs. Two loads of pollen, that is, two full pollen baskets, weigh an average of 20 mg. and contain about 4,000,000 pollen grains. This pollen

is stored in combs where, covered with honey, it changes into bee-bread.

Worker-bees may be called wax casters and master builders of remarkable combs with hexagonal cells that serve as extremely convenient receptacles for the storage of honey and bee-bread and as "cradles" for the brood.

The most amazing and fascinating thing about the life of bees is the construction of combs. Charles Darwin, who studied the life of bees for many years, said in his *Origin of Species* that: "He must be a dull man who can examine the exquisite structure of a comb, so beautifully adapted to its end, without enthusiastic admiration. We hear from mathematicians that bees have practically solved a recondite problem and have made their cells of the proper shape to hold the greatest possible amount of honey, with the least possible consumption of precious wax in their construction."

Worker-bees keep their hive scrupulously clean. With great skill they stop all crevices and polish the walls of their home with bee glue; if a mouse penetrates into a hive in search of honey, the workers sting it to death and then, to prevent the unpleasant consequences of its decay, cover it over with an air-tight coat of propolis. The air in the hive is always pure and fresh, the worker-bees not only ventilating the hive but maintaining the temperature in it at a constant level.*

Worker-bees guard the entrance to the hive and give battle at the first provocation.

A look at a comb teeming with thousands of busy bees

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* On a hot summer's day one can see rows of bees standing at the bee-entrance facing in one direction and working their wings vigorously. These are fanning bees, driving into the hive strong currents of cool air. Inside, another group of bees is engaged in driving over-heated air out of the hive. With the drop in the outside temperature bees gather into a denser cluster on the combs, in this way diminishing the surface area, intensifying metabolism and, consequently, raising the temperature within the cluster.

gives one the impression that bees never rest and are for ever occupied with their numerous duties.

But we have seen bees resting and even sleeping. Our own observations are borne out by the words of the well-known apiarist A. I. Root who repeatedly pointed out in his lectures on the life of bees that at night they are much more "dumpy" or "sleepy" than during the middle hours of the day.

Professor Karl von Frisch, the first to interpret the "language" of bees, wrote: "One who gets to know the inner life of the hive will soon see how much time bees of every age group spend in complete idleness."

The functions of all the organs of workers (as well as of queens and drones) are controlled and directed by a nervous system consisting of three departments; central, peripheral and sympathetic. Two parts are distinguished in the central nervous system: the brain and the ventral nerve cord consisting of a series of ganglia. The function of the bee's brain can be compared with that of higher animals, and of the ganglia—with the spinal cord. Precise measurements have established the weight of the brain of different insects. It is interesting to note that among insects the ratio between the weight of the brain and the body has been found to be the highest in worker-bees—1/174; in ants this ratio is 1/286, in cockchafers—1/3920, in water-beetles—1/4200. Moreover, it has been found that the worker-bee has a much larger brain than the queen or the drone. The brain of a bee consists of a layer of cells, which forms stalk-like or fungus-shaped bodies which are believed to be the centres of higher nervous activity. Researchers have established that these fungiform bodies are best developed in worker-bees, which is explained by the variety of duties they have to perform.

In the words of Academician V. Natali: "Worker-bees are characterized by very complex behaviour and that is the reason the brain of the workers (especially its fungi-

form bodies) is much better developed than that of queens, to say nothing of drones."

One of the two ganglionic masses in the head—the brain—situated above the oesophagus, gives off nerves to the eyes, the antennae and the labrum. On either side of the brain are the optic lobes and the compound eyes. The ventral nerve cord is the continuation of the brain. From the body ganglia nerves go to the entire ventral part of the bee's body. Owing to the presence of nervous ganglia in every part of the body, co-ordination of the activity of all the organs and muscles is not controlled by the brain alone. A decapitated bee can move and react to irritations, while the sting, torn from the body together with the stinging apparatus, continues to be active. The sympathetic nervous system consists of the frontal ganglion and a few small ganglia in the body and gives off nerves to the circulatory, digestive and respiratory organs.

The bee has five eyes, of which two are compound and three simple eyes, or ocelli. It is believed that the simple eyes enable the bee to distinguish objects at close range (at a distance of one or two centimetres) and find her way in the hive, while the compound eyes are used for long-distance vision. Another conjecture is that the ocelli are organs helping the compound eyes in the performance of their functions. The surface of a compound eye of the worker-bee consists of about 5,000 (in the case of the queen also of 5,000 and of the drone—8,000) hexagonal facets from which tapering tubes extend inwards and terminate in nervous radicles. Each individual facet perceives part of the object seen. The thousands of partial impressions blend in the bee's brain and she receives a mosaic picture of the object. This kind of vision is known as mosaic. Experiments have established that bees distinguish blue, yellow and white colours, are completely insensitive to red and confuse green with yellow or blue.

The worker-bee has her compound eyes on the sides and the ocelli on top of her head.

The bee's organs of smell lie in her antennae whose surface is pierced by a great number (nearly 500,000) of pores, each containing nerve endings. Between these plate organs there are innervated hairs serving as tactile organs. Therefore, the antennae are simultaneously olfactory and tactile organs.

The bee's organs of taste are chitinous "pegs" on parts near the mouth, connected with nerves. Liquid food stimulates the nerve endings on the "pegs." As a result of this arrangement, bees, especially worker-bees, have a highly developed sense of taste. For example, a four per cent solution of sugar does not seem sweet to bees and they would rather starve than take it; they likewise refuse to take a saccharine solution, probably objecting to its "metallic" taste. However, they readily make honey from sugar syrup with an admixture of quinine.

Worker-bees have a well-developed "sense of time." They visit flowers only when nectar or pollen is available.

So far, bees have not been discovered to have any organs of hearing, but beekeepers know for certain that bees are sensitive to sounds, especially to the clanging of metal.

Many naturalists and researchers have long sought to find out how bees communicate with one another. Some scientists believed that bees "spoke" by emitting different sounds. In 1788, M. J. E. Spitzner observed that when worker-bees returned to hive with nectar or pollen, they went through a series of movements which, many years later, were called "bee dances." Professor Karl von Frisch devoted much time and attention to the study of the behaviour of bees and related in his *Aus dem Leben der Bienen* that scout-bees inform their sisters of the location of sources of nectar or pollen by performing peculiar "dances." In his opinion the "round" dance announced a rich source of nectar and the "tail-wag" dance—of pollen.

In 1946, he wrote an article on bee "dances" in which he expounded his views in greater detail; ingenious experiments enabled him to establish that an incoming scout-bee informs the colony not of the character of her load (nectar or pollen), as he formerly believed, but of the distance of the food source from the hive. New observations showed that by performing the "round" dance, scout-bees tell their sisters that the source of nectar or pollen is near by, not farther than 25 metres from the hive. When scouts return and perform the "wag-tail" dance, the worker-bees know that they must prepare to fly far for nectar or pollen.

Thus, it was only recently that man fathomed yet another of nature's mysteries—the "language" of bees, their system of communicating by means of movements. In addition to "dance" signals, bees communicate with one another by sending scent signals—the product of their scent glands. This gland was discovered by N. Nasonov, a Russian investigator of the honey-bee, who described it in an article in 1883. The scent gland of the worker-bee (also called the Nasonov gland) is a minute fold near the back tip of the abdomen and exudes a smell like that of lemon or melissa, a honey-bearing plant.

A. I. Root, K. von Frisch and other students of bee life and behaviour hold that every bee colony has its own odour and that this is the reason few bees risk entering strange hives. This prevents honey stores from being pilfered by robber bees. Root believes that "as a dog recognizes his master by his keen sense of smell, so bees distinguish between one of their own colony and a stranger."

Daily observations at the apiary show that in admitting home-coming bees into the hive, the sentry-bees vigilantly guarding the entrance are undoubtedly guided by their sense of smell, the "colony odour" serving as the watchword. The sense of smell also guides bees in their trips for nectar and pollen and in finding their way home.

Some of the author's experiments, however, tend to dis-

prove the widely held opinion that bees have an exceptionally fine sense of smell: if the hive is shifted but a few inches from its usual place, the home-coming bees will be unable to find the entrance and, instead, will be seen "hovering" near the wall of the hive in the exact spot where the entrance used to be.

The fact that scented food is an excellent stimulus sending bees to some honey plant or other is today known not only to bee-scientists but to every beekeeper.

At state- and collective-farm apiaries bees are "trained" to work certain honey plants. This is done by developing conditioned reflexes in them with the help of scented syrups. In olden times, beekeepers used to give bees linden or buckwheat honey in the evening when they wanted them to work these plants in the morning.

This seemingly simple method is of immense importance for agriculture, because a bee colony trained to pollinate a definite plant is ten times more effective than an untrained colony. But then the question arises: how is it that bees reach fragrant flowers located two or three kilometres away from the hive and yet cannot with their sense of smell find the entrance of their own hive when it is shifted only a few inches? In this respect one cannot but agree with A. E. Brehm, the eminent naturalist, who more than half a century ago said that "we cannot assert with conviction that we understand everything about the amazing organism of the bees' social structure and to this day true beekeepers, i.e., those who breed bees not merely to obtain honey and wax but to study the character and work of these useful insects, are finding much that is new and interesting in their life."

The life of a bee colony is extremely interesting and the behaviour and many-sided activities of bees frequently fill people with astonishment, so much so that they ascribe to bees human emotions, such as joy, sorrow, love, and so forth. Such notions about bees, however, are erroneous, because thought and conscious labour are peculiar only to

human beings. As Karl Marx said in his *Capital,* "... a bee puts to shame many an architect in the construction of her cells. But what distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality."*

Every year bees give man millions of tons of honey and wax, which are indispensable raw materials for industry and medicine, and also propolis—bee glue. In recent years bee-bread, too, was added to the products taken from bees, as it is an excellent food containing proteins and vitamins. The role of the worker-bee in cross-pollinating entomophilous plants cannot be overestimated, because pollination through the agency of bees results in greatly increasing the harvests of cereal, fodder, essential-oil and industrial crops, as well as of fruits, berries, melons and vegetables.

The achievements of beekeeping in the Soviet Union are shown at the U.S.S.R. Agricultural Exhibition.

In his preface to Professor B. N. Shvanvich's *The Relationship Between Insects and Flowers*, Ivan Pavlov said: "The author gives a detailed description of his signally interesting experiments with insects.... These experiments deal not only with the stereotyped, inborn, so-called instinctive activity of insects, but with such activity as is based on individual experience.

"Thus we see that these insects have two types of behaviour: a higher and a lower, an individual one and one pertaining to the species. It is clear that the mechanics of the former is a challenge to the human mind and its extensive study in most varied fields of the animal kingdom is an important method of solving this problem."**

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* K. Marx, *Capital*, Vol. I, Moscow 1958, p. 178.

** I. P. Pavlov, *Collected Works*, Vol. I, U.S.S.R. Academy of Sciences, 1940, p. 408.

HOW BEES PRODUCE HONEY

Everyone has seen bees on a bright summer's day hovering over flowers, from which they collect drops of sweet nectar. To produce a hundred grammes of honey, a bee must visit nearly a million flowers. With her proboscis a bee sucks up nectar and when her honey-stomach (see Fig. 3) is full, flies back to her hive. A bee can fly at a speed of 65 kilometres an hour, that is, as fast as a train. Even when she carries a load equal to three-quarters of her weight she can develop a speed of 30 kilometres an hour.

To produce a kilogramme of honey, a bee must bring from 120,000 to 150,000 loads of nectar. Suppose that the flowers from which the bee collects nectar are located a kilometre and a half from the hive, then the forager has to fly three kilometres for each load, altogether from 360,000 to 450,000 kilometres, which is 8.5 to 11 times the distance round the equator.

A bee gets into the hive through the bee-entrance past the "sentries," guarding it against strange bees or other insects. In the hive, the forager is met by house-bees which receive the nectar. For some time the nectar is kept in the house-bee's honey-stomach, where it is further processed (the processing starts in the forager's honey-stomach on the way from the field).

A house-bee opens her mandibles sidewise, stretches her proboscis forward and downwards, and a droplet of nectar appears at the tip of the proboscis. Then she again draws the drop into the honey-stomach and folds back the proboscis. The regurgitation and swallowing of the drop of nectar is repeated from 120 to 240 times, after which the bee finds an empty hexagonal cell and deposits the drop in it. But this is still nectar, and before it becomes honey other bees will carry on processing it.

When house-bees are too busy, the foragers themselves attach their load—a drop of nectar—to the upper wall of

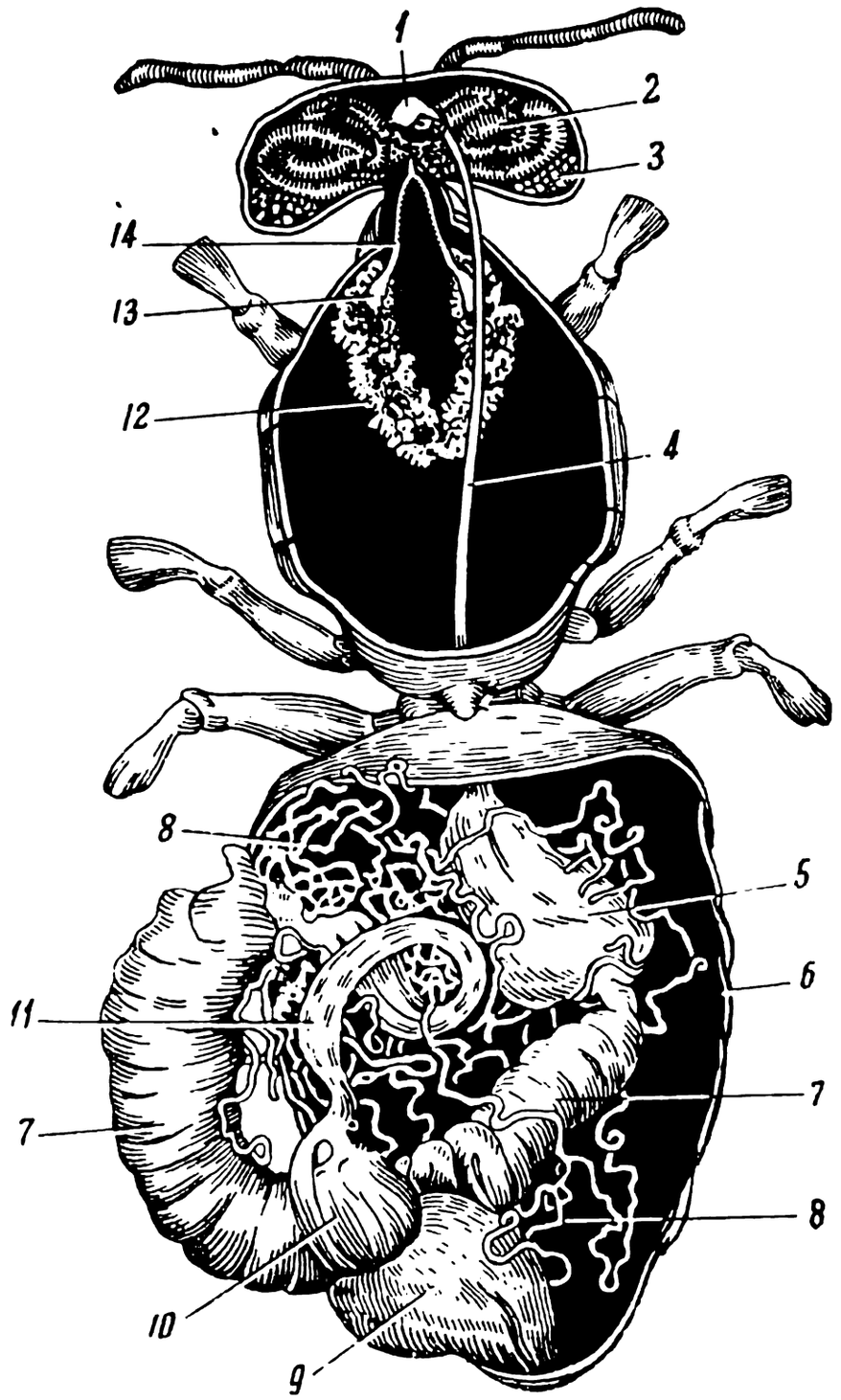

Fig. 3. Alimentary canal of a worker-bee
1. Pharynx; 2. Pharyngeal glands; 3. Salivary glands (postcerebral); 4. Oesophagus; 5. Honey-sack (honey-stomach); 6. Proventriculus; 7. Ventriculus; 8. Malpighian tubules; 9. Rectum; 10. Rectal gland; 11. Small intestine; 12. Thoracic glands; 13. Reservoir of the thoracic salivary glands; 14. Salivary duct

the cell. This is very important from the practical viewpoint, as hanging drops have a larger surface area, which facilitates the evaporation of moisture from the nectar. Nectar contains from 40 to 80 per cent water and sometimes as much as three-quarters of it must be removed to produce honey. To achieve this end, bees carry every drop of nectar several times from one cell to another, until part of the moisture is evaporated and the green honey becomes viscous. Evaporation is facilitated by the work of many bees, which by fanning their wings (a bee flaps its wings 26,400 times a minute) set up an additional circulation of air in the hive.

In addition to this purely mechanical concentration of nectar through evaporation, it is also concentrated in the bee's honey-stomach. Academician I. Kablukov holds that the cells of the honey-stomach, too, absorb water, which goes to the haemolymph and, by way of the Malpighian tubules, into the rectum and is ejected from the body. In this way the drop of nectar diminishes in the body of a worker-bee, as its water is absorbed by the cells of the honey-stomach. Then it receives enzymes, organic acids, disinfectants, and some other substances. From the honey-stomach the drop is again transferred to a cell, and the procedure is repeated until nectar becomes honey. Ripe honey contains no more than 18 to 20 per cent moisture.

When cells are filled with honey, bees seal them with wax caps, and in this fashion honey can keep for many years.

A bee colony can collect as much as 150 kilogrammes of honey in a season.

When bees are given the opportunity of collecting nectar from flowering plants of one variety, the honey they produce is more or less homogeneous and is named after the plant from which it has been collected.

Comb honey has the best flavour and is the most expensive because it comes in natural packing—the combs made by the bees themselves.

There is a special kind of honey which bees produce from vegetable and animal sources, such as honey dew appearing on some plants and the high-sugar-content liquid excretions of certain insects (aphids, leaf-hoppers, psyllidae, etc.). Bees readily collect these excretions and the honey they make from them is used mainly in confectionery and in the brewing industry.

Without laboratory tests* only a taster can tell by a peculiar scent and flavour if honey contains an admixture of honey-dew honey.

POISONOUS HONEY

Poisonous honey was known in antiquity. In describing the retreat from Asia Minor of 10,000 Greeks, Xenophon, the Athenian historian and general, speaks in detail about the sickness that overtook his men after they had eaten honey in Colchis. "The number of beehives was extraordinary, and all of the soldiers who ate of the combs lost their senses, vomited, and were affected with purging, and none of them were able to stand upright. Those who had eaten little were like men intoxicated, those who had eaten much were like madmen, and some like persons at the point of death. They lay upon the ground in consequence, in great numbers, as if there had been a defeat: and there was general dejection. The next day no one of them was found dead; and they recovered their senses about the same hour that they lost them on the preceding day; and on the third and fourth day they got up as if after having taken physic."

In 1877, poisonous honey was discovered in the Valley

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* Alcohol reaction is used to determine the presence of honey-dew honey. Six parts of 96 per cent alcohol are added to a one-to-one solution of honey in distilled water. The appearance of turbidity indicates the presence of honey dew. A field laboratory has been designed by Candidate of Agriculture V. Temnov determining the quantity of honey dew in honey.

of Batumi, not far from where the above historical episode had taken place. Beekeepers in this area could use only wax, because the honey produced dizziness, a state of inebriation and vomiting. The poisonous properties of the honey were ascribed to the abundance of rhododendron, the nectar of which was discovered to contain a glucoside of andromedotoxin.

Honey produced in the mountainous regions of central and northern Japan often causes a transient indisposition, which is due to the toxic action of the nectar contained in a plant of the heather family, called *Hotsutsayi* locally. Azalea, monk's-hood and andromeda honeys are also poisonous.

In his story *The Birth of a Man* (1896) Maxim Gorky says: "... In hollows of old beeches and lindens you can find heady honey which in antiquity nearly destroyed the troops of Pompey the Great, knocking down a whole Roman legion with its intoxicating sweetness. Bees make this honey from mountain laurel and azalea."

In the Far East, according to Z. Gutnikova, bees produce poisonous honey by collecting the nectar of the leather-leaf (*Chamaedaphne calyculata Moench*). This plant carpets thousands of acres, forming extensive overgrowths; it blooms for a period of 20 to 30 days and gives nearly three kilogrammes of honey per day per bee colony.

This honey is yellowish, somewhat bitter and granulates easily; it is poisonous, the reaction being cold sweat, shivering, nausea, vomiting and a violent headache. Observations have shown that 100-200 grammes of this honey leads to loss of consciousness and to delirium. But it is an interesting fact that leather-leaf honey, which is poisonous for man, does not affect bees. Bees feeding on this honey both in summer and winter showed no signs of injury.

I. Molochny found that in Khabarovsk Territory bees produce "heady honey" from the flowers of ledum (*Ledum palustre L.*), or marsh tea, a low shrub growing in swamps

and peat-bogs. The white flowers of this plant with their intoxicating scent attract bees, which produce poisonous honey from them.

I. Molochny suggested a method of making "heady honey" harmless by heating it for three hours at a temperature of 80 to 90° C. Under this method, the honey should be stirred all the time so that it does not boil. Such prolonged heating destroys the poisonous substances in the honey and makes it fit as a food. Prolonged heating, however, causes the honey to lose its remarkable organoleptic properties. In this connection, K. Sharashidze has worked out a method of heating "heady honey" at a temperature of 46° C. and a pressure of 67 mm. This way the organoleptic properties of honey are not destroyed. Many examples could be given to show that together with the nectar of poisonous plants, bees transfer poisonous substances to the honey that they produce from that nectar. Bees feed on this honey without any harmful effect, but not so people. Observations that have come down to us through the centuries are confirmed by experiments on animals, establishing that though poisonous honey has the same properties as ordinary honey, it contains a substance that is poisonous. The symptoms of poisoning are identical with those described by Xenophon more than 2,000 years ago. Poisonous honey is called "heady," because it causes dizziness, nausea, sharp abdominal pains.

In 1951, K. Sharashidze made a series of interesting biological experiments at the Sanitation Research Institute of the Ministry of Public Health of Georgia, which showed that the toxic properties of "heady" honey are due to the poisons in the nectar of azalea and rhododendron. Sharashidze gave guinea-pigs various doses of "heady" honey and found that 10 grammes of this honey caused tremors of the jaws, vomiting and convulsions, while 15 grammes killed the animals. The control animals that were given ordinary honey remained healthy. In another series of experiments guinea-pigs were given an alcohol and water ex-

tract (with the alcohol removed) of azalea and rhododendron flowers and also the nectar of these flowers. The animals showed the same signs of poisoning as in the case of "heady" honey.

Further experiments by Sharashidze in 1954 showed that "heady" honey contains a special kind of pollen. Using analytical methods and making biological experiments on animals, Sharashidze established that both the pollen and nectar of azalea and rhododendron contain a toxin similar to that found in "heady" honey. Owing to the volatile nature of the toxin in "heady" honey, the latter becomes less toxic in the course of time even if kept under ordinary conditions.

We know from literature that the honey from such poisonous plants as henbane, foxglove, oleander and hemlock is harmless to man.

KINDS OF HONEY

There are dozens of various honeys differing in several characteristics, the most important of which are floral, regional and technological.

The floral characteristic shows the source of the nectar: flowers or honey dew. The floral characteristic also helps us to distinguish monofloral honey produced from the nectar of one of the principal honey-bearing plants, such as buckwheat, linden, black locust, fireweed, sunflower, sainfoin and phacelia, and polyfloral honey produced from the nectar of several honey plants.

It goes without saying that completely monofloral honey, i.e., honey collected exclusively from the flowers of a single plant species, is rare. For practical purposes, a honey is considered monofloral when the nectar of some one plant is predominant in it, for example, the nectar of linden predominates in what we call linden honey. A negligible admixture of the nectar of other honey plants does not influence its specific fragrance, colour and flavour.

A polyfloral honey derives its name from the bee pasture where it has been collected, as, for instance, meadow, steppe, orchard, mountain-taiga and so forth.

The regional characteristic shows the region where the honey was produced. Thus, linden honey is subdivided into different kinds, such as Far-Eastern, Bashkirian, and so on.

Technologically, honeys are, according to the method of procurement and treatment, divided into comb honey and extracted honey. Comb honey is the honey that bees deposit in hexagonal cells, which they seal with wax cappings. This honey reaches the consumer in its natural packing, perfectly ripe and pure. Bacteriological tests have shown that comb honey is sterile. Extracted honey is obtained with the help of a centrifugal honey-extracting machine. The consumer receives it in jars, glasses or weighed out from barrels.

The quality of honey is usually judged by its appearance, fragrance and flavour. Colour, fragrance and flavour also indicate the kind of honey. There are light, medium-dark and dark honeys. Many kinds of honey are distinguished from each other not only by their basic colour but also by a multitude of shades. Some kinds are quite colourless—light and transparent like water. The combs filled with such honey seem empty, while a glass jar containing it is quite transparent. Light honeys belong to the highest grades. A. I. Root says that "the best honeys are usually spoken of as 'water-white,' and though this is not quite correct, still it is near enough for all practical purposes without coining a new word." Some authors, however, assert that dark honeys contain more mineral salts, chiefly iron, copper and manganese, and must, therefore, be considered as being more valuable as foods than the light sorts.

The kind to which a honey belongs can also be determined by its fragrance. Some honeys have an exceedingly delicate and pleasant scent; in the words of Gogol's bee-

keeper Rudy Panko in *Evenings on a Farmstead near Dikanka*: "... And take my word for it, you will find no better honey in any other hamlet. When you bring a honeycomb, the scent in the room is something you can't imagine—clear as a tear or a costly crystal such as you see in earrings." Along with fragrant honeys (citrus, black locust, linden, etc.) there are honeys with disagreeable smells, for instance, tobacco honey.

Most natural honeys have a delicious flavour, a fact which has caused poets and bards since ancient times to compare with honey all that is good and pleasant.

Thus Homer said about Nestor: "His words flow like sweet honey!" Solomon compared the sweetness of love with the sweetness of comb honey. Shakespeare likened sweet music to sweet honey. Vladimir Dal, outstanding Russian physician, writer and lexicographer, gave in his Dictionary many Russian proverbs extolling honey and showing how highly the people value it.

The following is a short list with descriptions of the most common kinds of honey.

Alfalfa (*Medicago sativa L.*) honey is collected from the lilac or purple blossoms of cultivated alfalfa. Newly extracted alfalfa honey comes in different shades: from colourless to amber; it crystallizes quickly, becoming a creamy white mass. This honey has a pleasant aroma and specific flavour. It contains 36.85 per cent glucose and 40.24 per cent levulose.* A hectare (2.471 acres) of alfalfa in bloom on irrigated lands yields 380 kilogrammes of honey.

Angelica (*Archangelica officinalis Hoffm.*) honey is collected from the flowers of angelica or archangel, which is widespread in the Soviet Union. This honey has a pleasant aroma and flavour.

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* Levulose (fruit sugar) is the sweetest of natural sugars: it is 1.7 times sweeter than saccharose—cane and beet sugar—and 2 to 2.5 times sweeter than glucose.

Apple (*Pyrus malus L.*) honey is pale yellow with an exceptionally pleasant aroma and a delicate sweetness. It contains 31.67 per cent glucose and 42 per cent levulose. It is collected from the blossoms of apple-trees, which in the U.S.S.R. are grown on nearly 70 per cent of the areas under orchards. A hectare of apple-trees in bloom yields 20 kilogrammes of honey.

Asclepias (*Asclepias syriaca L.-A. cornuti Des.*) honey is produced from the fragrant nectar of this valuable honey plant. It has been calculated that from the nectar collected from a single hectare under asclepias bees produce an average of 600 kilogrammes of honey. This honey is light with a yellowish tint, has a fine aroma and excellent flavour. In hot, dry weather the honey in the combs condenses to such an extent it can hardly be extracted even when it is heated.

Barberry (*Berberis vulgaris L.*) honey is golden yellow with a pleasant aroma and delicate sweet flavour. Bees visit blossoming barberry bushes very willingly. These bushes, which are about three metres tall, grow in the western, central and southern parts of the Soviet Union and are cultivated extensively for their haemostatic properties that were known to the Babylonians and ancient Indians.

In the "Assur-bani-pal Library" there are 2,600-year-old clay tablets with inscriptions indicating that barberries can "clean the blood." Ivan Michurin was interested in barberries and in 1893 evolved a seedless variety.

Bilberry (*Vaccinium myrtillus L.*) honey is reddish and possesses an excellent aroma and pleasant flavour. It is produced from nectar in the blossoms of the low bilberry shrub, a very good honey plant which can yield 2.5 kilogrammes of honey a day.

Blackberry (*Rubus caesius L.*) honey is water-white and has a pleasant flavour. It is collected from the lovely flowers of the shrub, which is widespread in the U.S.S.R. Bees

collect 20 kilogrammes of honey from a hectare of blackberry in bloom.

Black locust (*Robinia pseudoacacia L.*) honey is one of the best kinds of honey. In a liquid state it is transparent, and when it crystallizes, it turns into a white, fine-grained substance, not unlike snow. Locust honey contains 35.98 per cent glucose and 40.35 per cent levulose. A hectare under locust yields 1,700 kilogrammes of honey.

Bees also produce honey from the nectar of the pea-tree (*Caragana arborescens Lam.*). This honey is light but when it crystallizes it turns into white, medium-grained, fatty substance. This, too, is one of the best honeys. A hectare of pea-trees in blossom yields 350 kilogrammes of honey.

Blueweed (*Echium vulgare L.*) honey ranks among the best kinds; it is light amber in colour and has a pleasant aroma and very fine flavour. This honey is very viscous and granulates slowly. Bees collect it from the pink and bright blue flowers of the plant, which grows in extensive areas in the south of the U.S.S.R. Blueweed is a valuable honey plant, a hectare yielding from 300 to 400 kilogrammes of honey.

Borage (*Borago officinalis L.*) honey comes from the nectar of the beautiful big blue flowers of borage cultivated as a valuable honey and medicinal plant. This honey is light, transparent and has a pleasant flavour. Bees collect 200 kilogrammes of this excellent honey from a hectare of borage.

Buckwheat (*Fagopyrum esculentum*) honey is dark, ranging from dark yellow with a reddish tint to dark brown. In contrast to other honeys it has a peculiar aroma and specific flavour. When granulated, it turns into a pulpous mass. Some tasters assert that buckwheat honey "tickles your throat."

Buckwheat honey contains 36.75 per cent glucose and 40.29 per cent levulose, while its protein and iron content is higher than that of light honeys; that is why it is re-

commended for anaemia. In colour buckwheat honey resembles honey-dew honey.

Bees produce this honey from the nectar of the blossoms of buckwheat, which is grown on vast areas (in the Ukraine alone hundreds of thousands of acres are sown to this plant annually). A hectare of buckwheat yields up to 60 kilogrammes of honey.

Burdock (*Lappa tamentosa Lam.* and *Lappa major Gaertn.*) honey is of a dark olive colour and has a sharp spicy aroma and a high viscosity. This honey is collected from the small dark-pink flowers of the common burdock. Bees collect an average of 600 kilogrammes of this tasteful honey per hectare under burdock.

Carduus (*Carduus nutans L.*) honey is among the best kinds. It may be colourless, greenish or of a golden (light-amber) colour, and has a pleasant aroma and flavour. It crystallizes in fine grains. This honey is derived from the handsome crimson flowers of the prickly weed—thistle, which bees like to visit.

Carrot (*Daucus carota L.*) honey is dark yellow and pleasantly aromatic. It is made from the nectar of the fragrant white flowers of the biennial umbelliferous carrot.

Chestnut (*Castanea sativa L.*) honey is dark and has a faint aroma and an unpleasant flavour. Bees produce it from the flowers of the beautiful chestnut-tree which in the Soviet Union grows mainly in the Crimea and the Transcaucasus.

Bees also produce honey from the nectar of the pale-pink flowers of the horse-chestnut (*Aesculus hyppocastanum L.*), a decorative tree. Unlike chestnut honey, this honey is colourless and liquid, easily granulates and is sometimes bitter. Chestnut honey is considered low-grade.

Citrus honey, one of the best kinds, has an exquisite aroma, similar to that of blossoming oranges, lemons and tangerines, and an excellent flavour. Citrus-trees are cultivated in Abkhazia, Adjaria and Georgia.

Colza (*Barbarea vulgaris R. Br.*) honey is greenish yel-

low, with a faint aroma and good flavour. It is unsuitable for long storage. Bees produce this honey from the nectar of the golden-yellow colza, a weed that frequently grows around lakes and swamps, in flood meadows, and so forth. A hectare of colza in bloom yields about 40 kilogrammes of honey.

Coriander (*Coriandrum sativum L.*) honey has a pungent aroma and specific flavour. It is collected from white or pinkish flowers of the aromatic plant, growing wildly in Central Asia and the Transcaucasus. A hectare of coriander in bloom yields 500 kilogrammes of honey.

Cornflower (*Centaurea cyanus L.*) honey is greenish yellow, with an aroma reminiscent of almonds and a peculiar, slightly bitter flavour. The cornflower is an excellent honey plant.

Cotton (*Gossypium L.*) honey is light with a specific aroma and delicate flavour. It granulates rapidly into fine grains and turns white. Cotton honey contains 36.19 per cent glucose and 39.42 per cent levulose. The flavour of honey collected from the leaf (extra-floral) nectaries of the cotton-plant in no way differs from honey collected from flowers. A hectare of cotton-plants in bloom yields from 100 to 300 kilogrammes of honey. Cross-pollination by bees increases the cotton crop by 40 to 56 per cent.

Dandelion (*Taraxacum officinale L.*) honey is golden yellow, very thick, rapidly granulates and has a strong odour and flavour. The honey is produced from the nectar of the dandelion, which grows everywhere in great profusion; it contains 35.64 per cent glucose and 41.50 per cent fructose.

Dragonhead (*Dracocephalum moldavicum L.*) honey is gathered from the blue-purple flowers of the annual essential-oil plant growing in a wild state in the Caucasus, the Altai, the Ukraine and in some other districts. This honey is light and transparent and has a pleasant aroma and taste. Dragonhead is a valuable honey plant, because its flowers contain a large quantity of nectar with a high sugar

content and a touch of lemon in its aroma. A hectare of dragonhead in blossom yields as much as 290 kilogrammes of honey.

Eucalyptus (*Eucalyptus globulus Labill.*) honey has an unpleasant flavour but is highly valued because in popular medicine it is used in the treatment of lung tuberculosis. The data given in literature on the curative properties of eucalyptus honey are contradictory: some authors (L. Gdansky) are enthusiastic in their praises of the honey, while others (N. Ilyin) consider that its value is overestimated.

This honey comes from the large solitary multi-stamened blossoms of the evergreen tree known as blue gum which is cultivated mainly in the subtropical zone.

If we take into consideration that eucalyptus oil and other pharmacological substances are extracted not from the blossoms but from the leaves, we may assume that the therapeutic value of eucalyptus honey has been largely overrated.

Hovenia (*Hovenia dulcis Thubg*) honey resembles linden honey but is somewhat darker. It has a strong aroma and very agreeable flavour. Bees collect it from the flowers of the hovenia-tree, which in the Soviet Union grows in the subtropical zone and is cultivated for its fruit and beauty.

Heather (*Calluna vulgaris L.*) honey is produced from the nectar in the tiny pink flowers of the heather shrub. It is dark yellow or red brown and has a faint aroma and a pleasant, if somewhat astringent, flavour. The honey is very thick and does not granulate easily. A hectare of blossoming heather yields 200 kilogrammes of honey.

Hibiscus (*Hibiscus cannabinus L.*) honey, when freshly extracted, is of a dull yellowish colour, turbid and possesses a very unpleasant flavour. A hectare of hibiscus in bloom yields 40 kilogrammes of honey.

Horehound (*Marrubium vulgare L.*) honey is light in colour, with a delicious aroma and flavour. Bees collect

this honey from the greyish-white flowers of the perennial white horehound growing in the south-west of the European part of the U.S.S.R., in the Caucasus and Central Asia. Bees visit horehound very willingly, as the nectar is fragrant and has a high sugar content. A hectare of this plant in blossom yields 50 kilogrammes of excellent honey.

Hyssop (*Hyssopus officinalis L.*) honey is regarded as one of the best kinds. It is produced from the nectar found in the dark-blue flowers of a shrub-like plant growing in a wild state in the Ukraine, Central Asia, the Altai and some other regions. Hyssop is cultivated as an essential-oil crop and for bee pasture.

Lavender (*Lavandula vera DC*) honey is highly valued. It is of a golden colour and has a delicate aroma. Bees produce it from the nectar found in the light-blue or lilac-purple flowers of the perennial essential-oil plant cultivated on the southern Crimean coast, in the Kuban and in the Caucasus.

Linden (*Tilia*) honey is one of the very best kinds and is highly valued for its exceptional flavour. When freshly extracted, it is very fragrant, transparent, of a yellowish or pale-green colour. Linden honey contains 36.05 per cent glucose and 39.27 per cent levulose.

Bashkir (Ufa) linden honey is colourless and granulates into a white coarse-grained mass. Amur (Far-Eastern) linden honey is of a dull-yellow colour. All linden honeys have a specific delicious aroma and excellent flavour in spite of a faint tinge of bitterness, which, however, quickly disappears.

Linden honey is widely used in popular medicine against colds, mainly as a sudorific.

Bees produce this honey from the nectar of the greenish-yellow blossoms of the lime-tree, whose fine honey-bearing qualities have earned it the name of queen of honey plants. This name is very apt, for bees can produce as much as 16 kilogrammes of honey from one tree, while

a hectare of lime-trees in bloom can yield over 1,000 kilogrammes of honey.

Maple (*Acer platanoides L.*) honey is light in colour and has an excellent flavour. Bees willingly visit the beautiful yellow-green blossoms of decorative maple-trees or bushes which abound in almost all the forests of the Soviet Union. A hectare of this species yields 200 kilogrammes and of the *Acer campestre L.* species up to 1,100 kilogrammes of honey.

Meadow, or compound, honey is golden yellow or yellow brown with a fine aroma and flavour. It is produced from the nectar of various meadow flowers.

Melissa (*Melissa officinalis L.*) honey has an excellent flavour. It is produced from the nectar of the fragrant lilac or pink flowers of melissa, which is widespread in the Caucasus and the Crimea and is cultivated in the Ukraine as a medicinal and essential-oil plant. A hectare of blossoming melissa yields 150 kilogrammes of honey.

Mignonette (*Reseda odorata L.*) honey is a high-quality product with a delightful aroma and flavour that can rival that of linden honey. It is collected from the flowers of mignonette, which have an exceptionally pure, transparent nectar and lovely red-orange pollen. A hectare of mignonette in bloom yields as much as 200 kilogrammes of honey.

Motherwort (*Leonurus cardiaca L.*) honey is light yellow with a golden tint (straw-coloured), with a faint aroma and fine, specific flavour. It is collected from the pale-lilac flowers of motherwort growing on waste lands, in the vicinity of rubbish heaps and so forth. Each plant has more than 2,500 flowers gathered in clusters and containing an abundance of nectar with a high sugar content. Motherwort is a valuable honey plant and bees willingly visit it in all weather.

Mountain-ash (*Sorbus aucuparia L.*) honey is of a reddish colour, with a strong aroma and pleasant flavour. Bees produce this honey from the nectar of the blossoms

of the mountain ash, which is widespread in the Soviet Union. A hectare of mountain ash in bloom yields 40 kilogrammes of honey.

Parsnip (*Pastinaca sativa L.*) honey is light, with a fine flavour. It is produced from the nectar of the large yellow flowers of biennial parsnip, which grows wildly in the Volga area and the Bashkir A.S.S.R. Literature data show that in the Bashkir A.S.S.R. parsnip is second in importance to linden as a honey plant.

Peppermint (*Mentha piperita L.*) honey is produced from the nectar of the aromatic flowers of an essential-oil plant, which is widely cultivated in the Soviet Union and is an abundant source of honey. The honey is amber-coloured and has a pleasant peppermint aroma.

Phacelia (*Phacelia tanacetifolia Benth.*) honey is light green or white and has a delicate aroma and fine, pleasant flavour. It crystallizes into a pasty mass. This honey is considered one of the best kinds and is in high demand. Bees produce it from the nectar of the blue blossoms of the phacelia, which is one of the best and most important honey plants. A hectare of phacelia in blossom can yield 500 and even 1,000 (in the south) kilogrammes of honey.

Pumpkin (*Cucurbita pepo L.*) honey granulates easily, possesses a golden-yellow colour and an agreeable flavour. One hectare of pumpkin in bloom yields 30 kilogrammes of honey.

Rape (*Brassica napus var. oleifora Metzg.*) honey is white, sometimes yellow; it has an agreeable aroma but is unpleasantly sweet. The honey is very thick, granulates easily, badly dissolves in water and if stored for a long time will quickly ferment. Bees produce rape honey from the nectar of the yellow blossoms of a remarkable essential-oil plant. Instances are known from bee literature of one colony making as much as 8 kilogrammes of rape honey in one day. A hectare of rape in blossom yields 50 kilogrammes of honey.

Raspberry (*Rubus idaeus L.*) honey is white, with a

very pleasant aroma and delicious flavour. Raspberry comb honey is so tasty that it seems to melt in the mouth. This honey comes from the blossoms of the raspberry which grows in woods and orchards throughout the U.S.S.R. It is particularly plentiful in forests of Siberia, the Urals, and Kirov, Gorky and other regions, and holds a place of importance among fruit and berry plants. When raspberry is in bloom bees will pass by other honey plants and collect nectar from its blossoms; since the raspberry flower hangs down, the bee working it is protected by a kind of "umbrella" and can go on collecting nectar even in rain. A hectare of forest raspberry in bloom yields 70 kilogrammes, and garden raspberry—50 kilogrammes of honey. Raspberry honey contains 33.57 per cent glucose and 41.34 per cent levulose.

Rhododendron (*Rhododendron ponticum L.*) honey has an unpleasant flavour and causes poisoning (general weakness, headache, vomiting, loss of consciousness, etc.). There is evidence that the poisoning is due to the presence in rhododendron honey of alkaloid of andromedotoxin. It comes from the blossoms of the rhododendron, which grows in a wild state in the Transcaucasus.

Sage (*Salvia officinalis L.*) honey is of a light-amber or dark-golden colour, with a delicate aroma and pleasant flavour. Bees collect this honey from the purple flowers of a perennial shrub that is widely cultivated in the Ukraine, the Kuban and other regions. A hectare of sage in bloom yields 650 kilogrammes of honey.

Sainfoin (*Onobrychis sativa Lam.* or *O. viciaefolia Scop.*) honey is golden yellow and has an exceedingly pleasant aroma and flavour. It is produced from the nectar of the pink or red blossoms of the perennial fodder grass sainfoin, which grows wildly in Siberia and the Ukraine. A hectare of sainfoin in bloom yields from 100 to 600 kilogrammes of fine honey.

Salt-tree (*Halimodendron halodendron* [*Pall.*] *Voss.*) honey is light-coloured with a yellow tinge and easily

crystallizes. It is produced from the nectar of the large pink blossoms of a small prickly tree growing in Kazakhstan. A hectare of salt-trees in bloom yields over 190 kilogrammes of honey.

Sow thistle (*Cirsium oleraceum Scop.*) honey is white, with a pleasant aroma and flavour. This high-grade honey comes from the nectar of the numerous purple-red flowers of the sow thistle.

Sunflower (*Helianthus annuus L.*) honey is golden yellow but turns light amber, sometimes with a greenish tint when it crystallizes. It has a faint aroma and a pleasant, though pungent, flavour. Bees produce this honey from the golden-yellow flowers of the staple oil-bearing plant of the Soviet Union. Sunflower heads contain about 1,500 flowers, in working which bees cross-pollinate them, thus greatly increasing their fertility. It has been established that with bees actively working sunflowers, the crop yield nearly doubles. A hectare of sunflowers in bloom gives 50 kilogrammes of honey.

Sweet clover (*Melilotus officinalis Desr.*) honey has a delicious flavour and is considered one of the best honeys. Its colour is pale amber or white and the aroma has a suggestion of vanilla. Bees collect melilot honey from the bright yellow flowers of the large yellow sweet clover (*m. officinalis*). It contains 36.78 per cent glucose and 39.59 per cent fructose.

The flowers and leaves of the sweet clover (*Herba meliloti*) are used for medicinal purposes, as, for instance, to prepare green plaster. A hectare of sweet clover growing as a weed yields 200 kilogrammes, and of cultivated sweet clover—600 kilogrammes of honey.

Tobacco (*Nicotiana tabacum L.*) honey ranges in colour from light to dark, has an unpleasant aroma and a bitter flavour. Its poor organoleptic properties make it unsuitable as a food. Tobacco honey is used at factories to manufacture high-grade aromatic brands of tobacco. It can safely be used as winter food for bees. This honey is pro-

duced from the nectar of the flowers of tobacco plants grown chiefly in the Crimea.

Tulip-tree (*Liriodendron tulipifera L.*) honey is reddish in colour and has a pleasant aroma and flavour. Bees collect it from the greenish-red flowers of the handsome decorative tulip-tree, which is a good honey plant as its blossoms secrete more nectar than other subtropical honey plants. One tree yields one kilogramme of honey.

Vetch (*Vicia tenuifolia Koth.*) honey is made from the nectar of the vetch, which grows in Siberia and in steppe regions. The honey is transparent, has a fine aroma and flavour. There is evidence in literature that in Siberia a bee colony can make as much as five kilogrammes of vetch honey in one day.

White clover (*Trifolium repens L.*) honey is one of the best light honeys. It is colourless, transparent and has an excellent flavour. When crystallized, it becomes a hard white mass. White clover honey contains 34.96 per cent glucose and 40.24 per cent levulose. From a hectare of white clover bees can collect 100 kilogrammes of honey.

White mustard (*Sinapis alba L.*) honey is golden yellow when liquid and acquires a cream-yellow tinge when it crystallizes. Bees collect it from the large white flowers of the mustard; a hectare of mustard in bloom yields up to 40 kilogrammes of honey.

Willow (*Salix*) honey is golden yellow, granulates into a fine-grained creamy mass and has a fine flavour. The various shrubs and trees of the genus *Salix* (about 170 species) occurring everywhere in the Soviet Union are visited by large numbers of bees. Some of the species secrete an abundance of nectar, and sometimes bees can produce as much as 3 to 4 kilogrammes of honey a day, while a hectare yields 150 kilogrammes.

Willow-herb (*Epilobium angustifolium L.*) honey is transparent, with a greenish tinge, and crystallizes into white grains or a cream-like mass. When heated, willow-herb honey turns yellow. It has a delicate aroma and

pleasant flavour and comes from the nectar of the handsome red-purple flowers of the tall herb, known also as fireweed, Indian pink and rose bay, which occurs widely in the Soviet Union. A hectare of willow-herb yields 600 kilogrammes of honey.

Honey-dew honey is produced not from floral nectar but from the sweet liquid excreted by plant-lice (*Aphididae*), jumping plant-lice (*Psyllidae*) and bark-lice or scale-insects (*Coccidae*). These insects feed on plant juices and their excretions fall on the foliage of trees like dew, hence the term "honey dew."

Honey dew was known in ancient times and Pliny thought it fell from the stars, which belief was held for many centuries. Chemical analyses have shown that honey dew differs greatly from nectar: whereas floral nectar consists almost entirely of sugars, honey dew contains about 70 per cent nitrogenic substances and dextrin. Honey-dew honey is usually dark, viscous, with a faint aroma and an inferior flavour. Experiments have shown that, unlike floral honey, honey-dew honey possesses weak bactericidal properties.

Honey-dew honey kills bees if it is left as winter food. V. Temnov, V. Chistov, N. Silitskaya and other authors say that this harmful effect is due to the high mineral-salt content in honey-dew honey.

Radioactive honey. It has long been known that honeys differ not only in colour, aroma and flavour, but also in chemical, biological and curative properties. The chemical composition of honeys depends in a certain measure upon the plants from which they are collected, and even upon the soil on which the plants grow. Alin Caillas, the well-known French chemist who made an important contribution to the study of honeys, proved in 1908 that some kinds of honey contain radium. Glass tubes filled with honey were wrapped in opaque black paper and placed on photographic plates. A month later some of the plates were found to have impressions made by the radiation of radium.

This discovery is of paramount importance, because the radium reserves in the earth's crust are very negligible (25,000 times less than those of gold, 12,000 million times less than magnesium and 16,000 million times less than calcium). The therapeutic importance of radioactive honey is tremendous, especially in view of the use of radium* in the treatment of malignant tumours, such as cancer, sarcoma, etc.

Rock honey is a peculiar and rare honey. It is made by wild bees, which deposit it in rock crevices. The honey is pale yellow and has a pleasant aroma and flavour. In the combs there is little wax and the comb honey comes in the form of a solid crystallized mass from which pieces must be chopped off. Unlike ordinary honey, rock honey is not sticky and does not need a special packing. It can keep unchanged for years.

This honey is called *Abkhazian* for its regional characteristic, i.e., its place of origin.

In Bashkiria, rock honey used to be produced artificially from granulated linden honey. Moisture was evaporated from it in special kilns and the honey became as hard as stone. Naturally, the food value of such honey was impaired, as it lost many of its most valuable substances, such as enzymes, vitamins, etc.

TRAINING BEES TO OBTAIN HONEYS OF UNIFORM COMPOSITION

In 1948, bees at the apiary of the Lenin Collective Farm in Radishchev District, Ulyanovsk Region, were fed spoilt sugar which smelt of petroleum, because the honey flow in that locality was poor. On the first day that the bees

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* In 1934, Irène and Frédéric Joliot-Curie first obtained artificial radioactive atoms. Today many radioactive elements, such as phosphorus, cobalt, etc., are used in medicine, biology, agriculture, and other fields of science and in industry.

tasted it, swarms of them were seen around the repair shops: for two days they were stimulated by the smell of petroleum and sought a source of nectar with the same smell.

The day after bees were given sugar syrup smelling of lilac, there were much more of them on the lilac than on the blossoms of other plants.

That shows that very little time is needed to accustom bees to a certain smell. Another thing that came to light is that bees eating a scented syrup not only themselves collect the nectar with the scent of that syrup but also get their sisters to fly in search of it.

Progressive apiarists take advantage of this ability of bees to train them. The importance of this method is that greater numbers of bees are induced to leave their hives in search of the nectar of definite plants, consequently intensifying cross-pollination. Moreover, it enables man to control the activity of bees and send them at will to plants that require intensive cross-pollination. This method consists in giving bees, in the evening or early in the morning, 100 grammes of 50 per cent sugar syrup smelling of the flowers that have to be worked. The technique of preparing scented syrup is very simple: 50 grammes of sugar are dissolved in 100 cubic centimetres of hot water, and when the syrup cools, flowers amounting to a quarter of the volume of the syrup are steeped in it. The flowers must be freed from the green calyxes as their smell differs considerably from that of the flowers themselves. The syrup is infused for at least two hours in a vessel with a closely fitting lid to prevent the smell from dispersing.

It should be borne in mind that bees have a very fine sense of smell and the success of training will largely depend on the purity of the syrup. There must be no foreign smell in the fragrance of the particular flowers, and the syrup, therefore, should be made in a clean glass or enamelled vessel. The best procedure is to prepare the syrup

during the day, infuse it during the night and introduce it into the hive early in the morning before the bees are ready to leave the hive. The feeder with the syrup is placed on the frames, just as when the "express" method of obtaining honey is applied. The best results are achieved when baited syrup is fed to the bees throughout the period a given plant is in bloom. The foragers taste the fragrant syrup at break of day and then immediately start off for the plants with that smell. For bees, the fragrance of blossoming honey plants serves as a kind of beacon. Then, as they fly from the hive to the plants and back again, the bees themselves leave scent tracks along their airway.

Thus, training elaborates in bees a conditioned reflex, which helps them find a honey plant from among many others blooming in a field or orchard. In this way bees receive a command, as it were, to work the plant the beekeeper desires.

CHEMICAL COMPOSITION, FOOD AND CALORIC VALUE OF HONEY

There is much evidence in literature that since olden times honey has been known as an excellent food and medicine. Furthermore, it has been established that more than half the energy generated in the human body is derived from the sugars it receives with food.

Of all nutritive elements, sugar is the most quickly assimilated.

In 1893, the Italian physiologist Angelo Mosso proved with the aid of the ergograph that sugar considerably weakens the sensation of physical fatigue. The scientist Harley found that when he ate 525 grammes of sugar, his capacity for work that day increased by 61-76 per cent.

Observations have shown that athletes who eat plenty of sugar have greater staying power and win with less effort.

But beet and cane sugar and glucose* are assimilated by the human organism differently. Glucose is absorbed into the blood stream directly, without undergoing any changes (it may be injected intravenously, which is done in cases of many diseases), while sugar must first be broken down into its simple components (Fig. 4).

The hydrolysis of sugar takes place in the small intestine, where it is broken down into glucose and levulose by the digestive juices; these simple sugars are absorbed into the blood of the portal vein, which carries it into the liver, and thence distributes glucose to the tissues of the body.

Since honey consists almost entirely of pure glucose and levulose, it is clear what an easily digestible food it is. In addition to simple sugars, bee honey contains a number of substances necessary for the cells, tissues and organs to function normally.

The researches of I. Makeyev, V. Gulevich and L. Broude show that enzymes are more perfect and subtle means at the command of living organisms than the common reagents in the hands of chemists. For example, the hydrolysis of starch can be induced by heating it with water in sealed tubes or in an autoclave up to 170° C.; the same result can be obtained at a lower temperature if hydrochloric acid is added to starch, but a still better result is obtained with the addition of ptyalin, an enzyme of saliva. Fat can be converted into soap by boil-

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* Glucose, a component normally present in plants, is the product of photosynthesis. The process of photosynthesis can schematically be represented as follows: $|\overline{C|O|O}|$ is decomposed into $|\underline{C}| + |\overline{H_2O}| \rightarrow$ CHHO (formaldehyde) with O_2 released into the air. Six parts of formaldehyde combine chemically to produce glucose.

ing it with alkali at 100° C., while in the body soponification is effected by lipase at body temperature.

To illustrate the efficacy of minute doses of enzymes it is enough to mention peroxidase, an enzyme Academi-

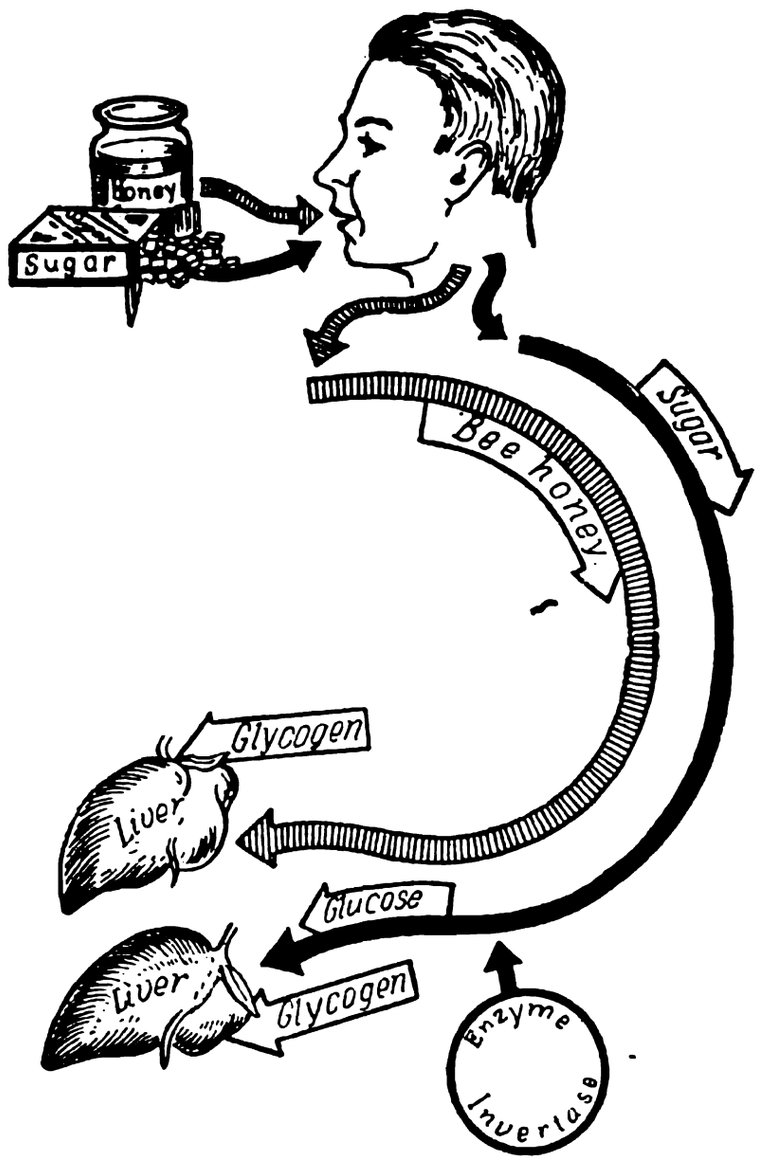

Fig. 4. Diagram showing the splitting of sugar (beet and cane) in the human body into glycogen and the direct storing of honey (glucose, levulose) in the liver without any changes. Beet or cane sugar is inverted into glucose and levulose by the enzyme invertase

cian A. Bach obtained from horse-radish, which is active in concentrations of even 1:200,000,000.

Bee honey has been discovered to contain the following

enzymes: diastase, invertase, catalase, peroxidase and lipase. Among foods, the enzymatic content of honey is one of the highest. Diastase (or amylase) converts starch and dextrin into sugar, invertase converts beet and cane sugar into glucose and fructose, catalase decomposes peroxides. Some scientists attribute the excellent properties of honey to the enzymes it contains.

Other constituents of honey are calcium, sodium, potassium, magnesium, iron, chlorine, phosphorus, sulphur and iodine salts; some honeys contain even radium. The percentage of some salts in honey is almost equal to their concentration in human blood serum. Table 1 shows the percentage of mineral salts in blood serum and in honey.

A spectral analysis of buckwheat and polyfloral honey in E. Przhevalski's laboratory at Moscow University showed that honey also contains salts of manganese, silicon, aluminium, boron, chromium, copper, lithium, nickel, lead, tin, titanium, zinc and osmium. Mineral salts are extremely important for the human organism. Experiments have shown that animals die when they are systematically given food that is lacking in mineral salts even though it may be rich in proteins, carbo-hydrates, fats and vitamins.

Table 1

Element	Human blood (after Palladin)	Bee honey (after Sherman)
Magnesium	0.018	0.018
Sulphur	0.004	0.001
Phosphorus	0.005	0.019
Iron	Traces	0.0007
Calcium	0.011	0.004
Chlorine	0.360	0.029
Potassium	0.030	0.386
Iodine	Traces	Traces
Sodium	0.320	0.001

In addition, honey contains some organic acids (malic, tartaric, citric, lactic, oxalic), proteins, vitamins, a derivate of chlorophyll, xanthophyll and other substances. In the opinion of V. Filatov, the famous Soviet ophthalmologist, honey contains biogenetic stimulants (substances increasing the activity of the body).

Experiments conducted at the Botanical Garden of Lvov University have established that honey contains growth factors (bioses). Branches cut off trees and planted after treatment with a water solution of honey, quickly took root and grew well.

Honey is a highly caloric food, one kilogramme containing 3,150 calories.

It is a pity that, in spite of the great advantages of honey over other foods, for instance, sugar, it is as yet insufficiently used in modern clinics and other therapeutic and prophylactic institutions. As a dietetic food, honey can be used simultaneously with all kinds of drugs and other therapeutic measures.

HONEY—A POTENTIALLY ALKALINE FOOD

Acid-neutralizing alkaline mineral salts are of great importance in maintaining the acid-alkaline balance of the body. The alkaline elements are potassium, sodium, calcium and magnesium, while sulphur, phosphorus and chlorine are acidic.

Rational diet is built up to maintain an alkaline balance, as an accumulation of free acids causes physiological disturbances which decrease the body's resistance.

It has been established that foods are potential sources of either acidity or alkalinity of the body, and this determines their role in metabolism. In prescribing a diet, it must be considered that meats, fish, eggs, fats, cereals and nuts are potential sources of acidity, while fruits, vegetables, berries (except red bilberries) and milk are potential sources of alkalinity.

Honey is a potentially alkaline food and this is of tremendous importance in determining its nourishing and therapeutic properties. Darker honeys contain more mineral salts than lighter ones, and therefore give higher alkaline values.

Investigations show that the colour of honey (and, consequently, its mineral salts content) is proportionate to its potential alkalinity (tables 2 and 3).

Table 2

Relation of Colour to the Potential Alkalinity of Honeys

Colour	Mean ash content, in ‰	Mean potential alkalinity (cc. normal alkali per 100 gms. honey)
Light honeys	0.16	1.01
Dark honeys	0.26	2.12

Table 3

Potential Alkalinity of Honeys of Different Floral Types

Floral type	Colour number Pfund col. scale or honey grader	Colour	Ash content in ‰	Potential alkalinity (cc. normal alkali per 100 gms. honey)
Sweet clover	0.6°	Water-white	0.04	0.27
Orange	1.2°	Extra white	0.05	0.50
White clover	3.0°	White	0.08	0.66
Pea-tree	8.5°	Amber	0.22	1.86

Thus the nutritive and therapeutic value of honey is further enhanced by its potential alkalinity and this explains in some measure its beneficial effect in the treatment of gastro-enteric diseases accompanied by high acidity.

VITAMIN CONTENT OF HONEY

Vitamins are not only essential food constituents; many of them are used as therapeutic agents. With the help of vitamins man has conquered such terrible diseases as scurvy, beriberi, rickets, pellagra and hemeralopia.

Academician A. Bach wrote that "vitamins, which only recently were considered dietetic factors of secondary importance producing a very limited specific effect, have acquired the significance of a factor of extreme biological importance. It would be hard to find a department of physiology or biochemistry that is not associated with the science of vitamins. Metabolism in living organisms, the activity of the organs of sense, the functions of the nervous system, fermentative processes, the phenomena of growth and reproduction—all these different and basic domains of biology are very closely connected with vitamins."

Academician A. Oparin considers vitaminology the cornerstone of modern dietetics. Without a thorough knowledge of vitamins there can be no understanding of the fundamentals of modern biochemistry and physiology.

Today, it is known for certain that vitamins participate in all the vital processes taking place in a living body (Fig. 5).

According to the latest data found in literature honey contains vitamins B_2, B_6, H, K, C and some others.

Vitamin B_2 (riboflavin) takes part in the metabolism of carbo-hydrates, fats and proteins, the absorption of glucose from the intestine, and helps to improve vision. Some authors (for instance, Golyanitsky) hold that riboflavin is a factor of non-specific immunity, that it increases resistance to staphylococcal and streptococcal infections. It possesses anti-infectious, antianaemic and antihaemorrhagic properties. Lack of vitamin B_2 in food causes the development of ulcerative colitis, increases the excitability of

the nervous system, causes lesions on the skin of the face, eye diseases and so on.

Investigations show that honey contains a considerable amount of riboflavin, almost as much as chicken meat, seventeen times as much as fresh apricots, sixteen times as much as grape juice and fresh apples, five times as much as lean cheese, dog-rose berries and raw carrots.

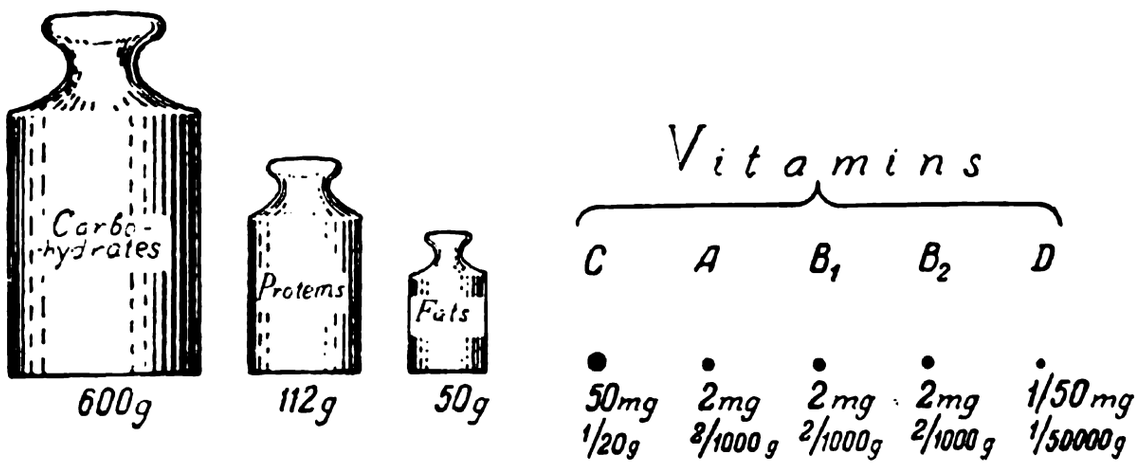

Fig. 5. The daily amount of vitamins a man needs as compared with carbo-hydrates, proteins and fats

Vitamin B_6 (pyridoxine) participates in protein metabolism and is an antidermatitic factor (it prevents skin diseases). Pyridoxine is indicated in cases of neuralgia and of some disturbances of the central nervous system. According to some data, lack of pyridoxine in food causes muscular weakness, irritability, convulsions and paralysis.

Vitamin B_3 (pantothenic acid) is the antidermatitic factor of chicks and takes part in the metabolism of carbo-hydrates. The consumption by animals of food that is rich in vitamin B_3 can prevent their wool from turning grey.

Vitamin H (biotin) takes part in the metabolism of fats and proteins and facilitates their assimilation. Biotin pre-

vents the development of eczema, herpes, furunculosis and psoriasis.

Vitamin B_c (folic acid) contributes to the maintenance of the normal volume of erythrocytes and the haemoglobin content of the blood. It is successfully used in cases of pernicious anaemia.

Vitamin K (antihaemorrhagic) is used in cases of loss of blood and also in traumatic haemorrhage.

Carotene (precursor of vitamin A) is essential for the regeneration of epithelium, the vision, and acts favourably on proliferation.

Vitamin C increases the resistance of the body to infections, participates in the processes of oxidation and reduction and in normal haemopoiesis.

Although the vitamins listed above are contained in honey in small quantities, they are of immense importance, because they come in combination with other substances such as carbo-hydrates, mineral salts and organic acids.

The vitamin content of honey (Fig. 6) depends on the admixture of pollen.* It has been established that when pollen is removed from honey by filtration, the honey loses almost all its vitamins.

GRANULATION OF HONEY

Freshly extracted honey is a homogeneous thick mass resembling syrup. A drop of such honey is transparent and of a light-amber colour. A microscope, however, will reveal that this drop contains regularly-shaped crystals (granules) of glucose, which form its framework, as it

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* Investigations show that a kilogramme of bee honey contains: vitamin B_2 (riboflavin)—up to 1.5 mg.; vitamin B_1 (aneurin)—up to 0.1 mg. vitamin B_3 (pantothenic acid)—up to 2 mg.; vitamin B_5 or PP (nicotinic acid)—up to 1 mg.; vitamin B_6 (pyridoxine)—up to 5 mg.; vitamin C (ascorbic acid)—30 to 54 mg.

were, and around which are grouped the other honey constituents.

Experiments show that the shape of the crystals and the

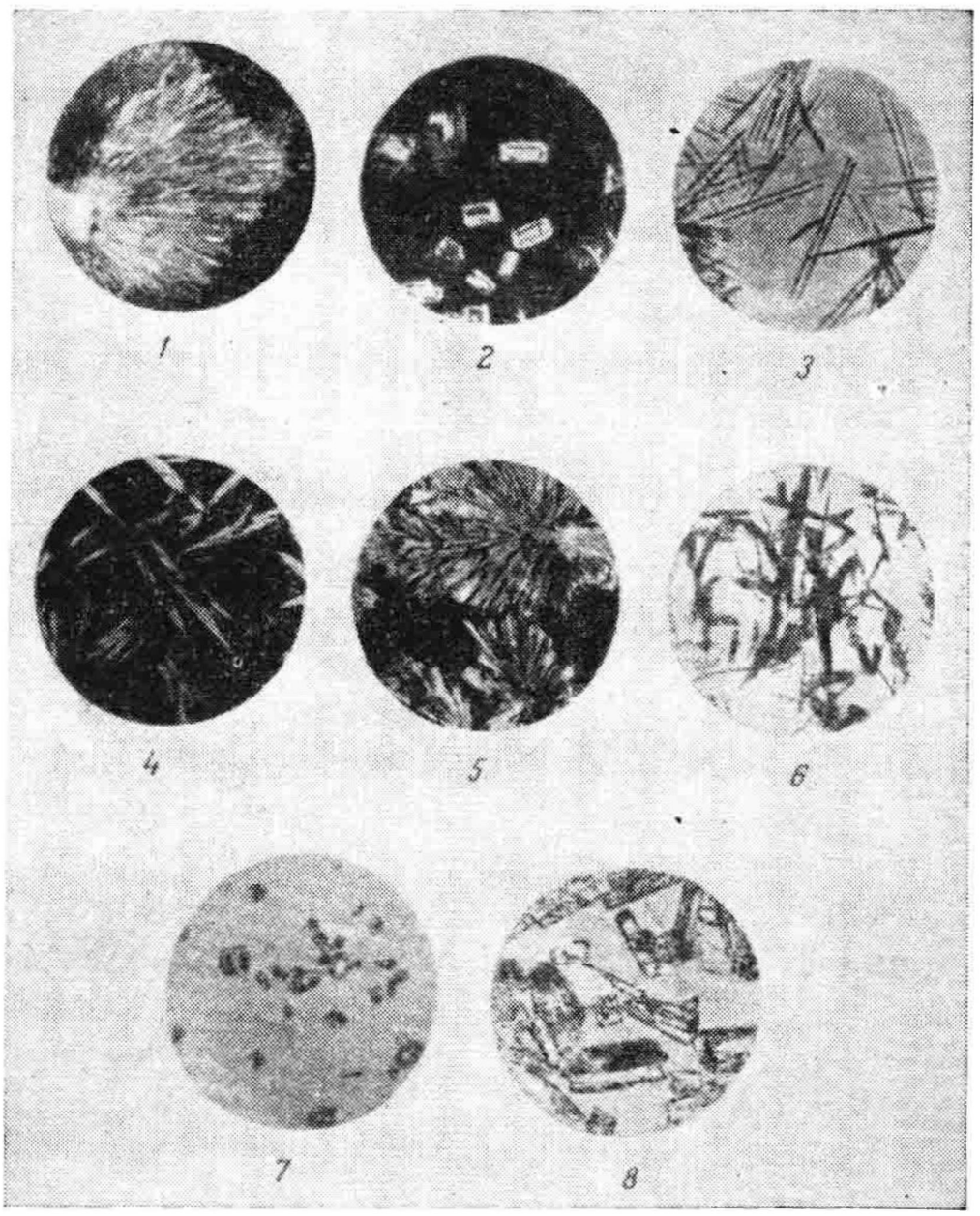

Fig. 6. Crystals of vitamins contained in honey:
1. vitamin B_2; 2. vitamin B_6; 3. vitamin H; 4. vitamin B_c; 5. vitamin C; 6. vitamin K; 7. precursor of vitamin A (carotene); 8. vitamin E

rate of crystallization depend on various conditions, chiefly on the number of primary glucose crystals and the spaces between them (after Professor A. Gubin and others).

Honey extracted from old combs has been found to granulate quickly into a fine-grained or fatty mass, owing to the presence of great numbers of primary crystals. Conversely, honey that is extracted from freshly-built combs is free from primary crystals and is, therefore, slow to granulate.

Temperature also influences the rate and degree of granulation. Crystals form more quickly when honey is kept in a warm place, because then its viscosity diminishes and the aggregate crystals—granules—form a sediment at the bottom. Honey is more viscous when it is kept in cold storage and sedimentation is so slow that the granules have time to grow and unite before they fall out.

HONEY AS A DISINFECTANT. ANTIBACTERIAL PROPERTIES OF HONEY

We have already stated that given proper storage, honey can keep for a long time without spoiling.

There is data to show that the ancient Egyptians and Greeks used honey to embalm their dead.

Abd al-Latif, a 12th-century Arabian physician and traveller, found a sealed vessel in one of the pyramids at Gizeh, containing a well-preserved corpse of an infant in honey. We know also that the body of Alexander the Great, who died during one of his campaigns, was immersed in a vessel of honey and in this way brought to the capital of Macedonia for burial. The same was done to the bodies of Agesipolis and Agesilaus, kings of Sparta, and of Aristobulus, king of Judea.

The ancient Greeks and Romans used honey also to preserve meat, which kept well and retained its natural flavour.

A century and a half ago, P. Sumarokov wrote: "A wonderful property of honey is that it protects plant sap, roots, flowers, fruit, and even meat from spoilage. That is

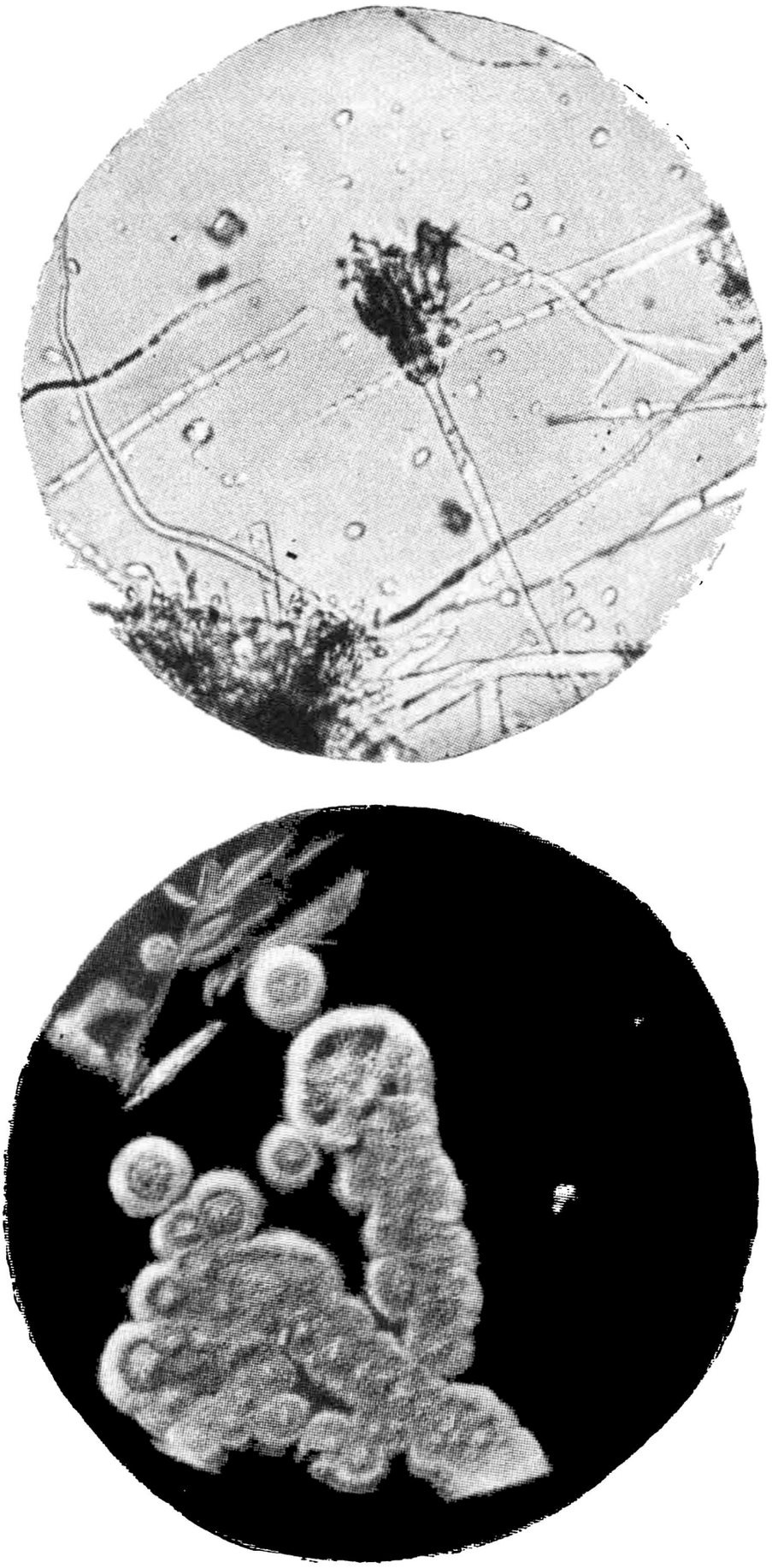

Fig. 7. *Penicillium Lagerheimi* N.S.P. Colonies on agar-plate (natural size); *Penicillium Lagerheimi* N.S.P. (magnified 640 times)

why the natives of Ceylon cut meat into pieces, dip them into honey and put them in tree hollows a few feet above the ground; then they stuff twigs into the hollow and leave it untouched for as long as a year, after which time they find the meat in perfect condition, sometimes even with an improved flavour."

The experiments of Gundel and Blattner on white mice infected with haemolytic streptococcus showed that honey inhibits bacterial growth and kills the bacteria Gonzenbach and Hoffmann inflicted lesions on the skin of guinea-pigs and introduced microbes into them; then they applied honey and the animals thus treated lived longer than did the control ones.

Some authors (König) say that these properties of bee honey are due to its high sugar concentration, others (Hayduschka, Kaufmann) ascribe them to the action of the organic acids in honey, and still others (Gundel, Blattner, Helfmann)—to the combined action of enzymes and sugar.

The reports of Dold, Lächele, Du and Dziao on the discovery in honey of photo- and thermo-labile antibiotics are of great interest. The scientists named these substances *inhibitors*.

Milan Prica considers the antibiotics in honey to be the product of the worker-bees' secretory activity.

The experiments made by Professor M. Neshchadimenko and A. Moroz jointly with the present author at the Kiev Medical Institute showed that new honeys obtained by the "express" method possess stronger disinfecting properties than natural and artificial honeys.

Of the ten kinds of honey we investigated, special mention should be made of No. 2—vitamin honey, No. 13—haematogen honey, No. 17—mammin-vitamin honey and No. 37—cocoa-milk-egg-and-vitamin honey. As can be seen from their designation, the new honeys contain milk, egg white and yolk, animal blood, etc., which under

usual conditions are perfect media for bacterial growth. Experiments were performed with pyogenic and intestinal microbes (typhoid fever, paratyphoid A and B, dysentery, streptococci, staphylococci, B. coli, the Breslau, Gärtner, Shiga and Schmitz bacilli).

A 24-hour bacterial culture was washed in a cubic cm. of saline and two drops of the emulsion was added to 3 cubic cm. of honey. The control samples were taken in equal amounts. The bacterial emulsion was uniformly mixed with the honey and was kept in a thermostat at 37°C. Passages were made after 1, 2, 3, 4, 5, 6, 7 and 8 days on agar-plates, serum-agar plates and broth. The cultures obtained were observed for medium on which bacterial growth occurred.

Altogether, 2,080 cultures were obtained. The experiments were repeated twice with similar results.

Table 4

Results of Microbial Cultivation* in Honey No. 13 (Haematogenic)

Bacterial culture	Results of daily bacteriological investigations							
	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
Streptococci	+	+	+	—	—	—	—	—
Staphylococci	+	+	+	—	—	—	—	—
Typhoid bacterium	+	+	—	—	—	—	—	—
Bacterium coli	+	+	—	—	—	—	—	—
Bacterium paratyphi A	+	+	—	—	—	—	—	—
Bacterium paratyphi B	+	+	+	—	—	—	—	—
Breslau bacterium	+	+	—	—	—	—	—	—
Gärtner Bacillus	+	+	—	—	—	—	—	—
Shiga bacillus	+	+	—	—	—	—	—	—
Schmitz bacillus	+	+	—	—	—	—	—	—

* Plus means presence of growth, minus—absence of growth.

Table 5

Results of Microbial Cultivation in Honey No. 37 (Cocoa-Milk-Egg-and-Vitamin)

Bacterial culture	Results of daily bacteriological investigations							
	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
Streptococci	+	+	+	—	—	—	—	—
Staphylococci	+	+	+	—	—	—	—	—
Typhoid bacterium	+	+	—	—	—	—	—	—
Bacterium coli	+	+	—	—	—	—	—	—
Bacterium paratyphi A	+	+	—	—	—	—	—	—
Bacterium paratyphi B	+	+	+	—	—	—	—	—
Breslau bacterium	+	+	—	—	—	—	—	—
Gärtner bacillus	+	+	—	—	—	—	—	—
Shiga bacillus	+	+	—	—	—	—	—	—
Schmitz bacillus	+	+	—	—	—	—	—	—

Table 6

Results of Microbial Cultivation in Control Honey (Natural Far-Eastern Linden Honey Harvested in 1939)

Bacterial culture	Results of daily bacteriological investigations							
	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
Streptococci	+	+	+	+	—	—	—	—
Staphylococci	+	+	+	+	—	—	—	—
Typhoid bacterium	+	+	+	—	—	—	—	—
Bacterium coli	+	+	+	—	—	—	—	—
Bacterium paratyphi A	+	+	+	—	—	—	—	—
Bacterium paratyphi B	+	+	+	+	—	—	—	—
Breslau bacterium	+	+	+	—	—	—	—	—
Gärtner bacillus	+	+	+	—	—	—	—	—
Shiga bacillus	+	+	+	—	—	—	—	—
Schmitz bacillus	+	+	+	—	—	—	—	—

The experiments showed that in media with a high sugar concentration (40 per cent glucose and 30 per cent levulose) with 0.02 per cent formic acid in the saline the above bacteria grew after incubation. The new kinds of honey as well as natural linden honey (control) exhibited high antibacterial properties, the new kinds proving more effective than natural honey.

Some data of the bacteriological investigations are given in tables 4, 5 and 6.

These investigations, as well as the 85 new honeys at our disposal obtained by the "express" method, prove that the antibiotic properties of honey are undoubtedly the result of the secretory activity of worker-bees.

ANTIMYCOTIC PROPERTIES OF BEE HONEY

The air around us abounds in spores of mould fungi. In favourable conditions of temperature, humidity and in the presence of food the spores germinate, and the developing mycelium penetrates into the food product as deep as 3 mm., sometimes deeper. As a consequence, products, such as flour, sugar, macaroni, all kinds of jams and preserves, unglazed sweets, fruit and beverages, acquire an unpleasant odour, flavour and change their appearance. Bearing in mind the enormous wastage caused by mould fungi, we became interested in honey for we found that it possesses antimycotic properties. The remarkable thing about the honey in the vessel found in a pyramid at Gizeh was that after more than 3,300 years it had preserved the characteristic aroma of honey. Experienced beekeepers have long been asserting that, unlike other foods, honey is not subject to moulding, when it is properly stored.

F. Kaganova-Yoirish, a scientific worker of the Mycology Laboratory at the Kiev Research Institute of Dietetics (Director—G. Pollak), investigated the antimycotic properties of honey. She took two kinds of honey: linden honey harvested in the Far East in 1939 and buckwheat

honey harvested in the Ukraine in 1940, as well as twenty samples of honey we had obtained by the "express" method. All the samples were infected with ten varieties of mould fungi isolated from food.

In spite of the fact that honey contains proteins, carbo-hydrates, vitamins, electrolytes and other substances necessary to sustain living cells, mould fungi not only did not proliferate in it but perished. We think this is due to the presence in honey of antibiotic substances possessing both antibacterial and antimycotic properties.

STORAGE OF HONEY

Bee honey can be kept in storage for a considerable time. Honey is known to keep for tens, hundreds and even thousands of years. It should be noted, however, that honey is highly hygroscopic, easily absorbs water and, consequently, begins to ferment. Experiments show that in a humid atmosphere, the weight of honey may increase by 33 per cent at the expense of absorbed air moisture.

Through a microscope it can be seen that a drop of honey contains a certain amount of yeast fungi, which can, at definite temperatures, cause fermentation. Scientists have discovered that it is caused by yeast fungi from the genus *Zygosaccharomyces*. Why then is comb honey free from fermentation in the hive where humidity is sufficiently high? The explanation is that in the hive the temperature is 30°C., a level at which yeast fungi cannot cause fermentation of honey, the optimum temperature for honey fermentation being from 11 to 19°C. Honey, therefore, should be stored at temperatures between 5 and 10°C., in dry and well-ventilated premises.

It should always be remembered that honey is easily impregnated with foreign odours and should not be kept in premises where there are such foodstuffs as herring, sauerkraut and the like, and substances with a strong odour (paraffin, tar, benzine).

Packing must be given careful consideration. The best and most convenient way of storing honey is to keep it in glass jars or glazed earthenware vessels.

Thick oil-paper may be used for granulated honey. To induce fresh honey to granulate, it is enough to add to it a thousandth part of grated granulated honey, and a day or two later the honey will have crystallized.

Honey stored in large quantities is kept in barrels made of linden, aspen, alder, poplar and other sorts of wood, containing not more than 20 per cent moisture—the moisture content of honey. That is very important. The wood of coniferous trees cannot be used, because the barrels made from this wood give honey the odour of pine. Oak barrels, too, are unsuitable, because honey turns black in them.

It is dangerous to store honey in metal containers, because iron combines with the honey sugars, while zinc, combining with the organic acids of honey, produces toxic substances.

We know from literature that honey kept in iron and zinc vessels was found to contain 19.79 per cent of these metals, the usual percentage of which in honey is 0.16.

For the convenience of consumers it is important that honey should be marked and labelled. The label on the container should indicate the kind of honey (linden, buckwheat, black-locust, etc.), the time and place of production, the colour (light-golden, dark-brown, etc.), the weight (gross and net) and the name of the producer.

BLENDING HONEYS

Honeys are blended in order to improve the organoleptic properties of the inferior kinds. That is done to produce a blend with a desirable colour (for example, amber or yellow honey is mixed with pure white honey), or flavour and aroma.

In this way the flavour of clover honey is improved by the addition of linden honey, of alfalfa honey—by melilot honey, of sunflower honey—by linden honey, and so forth.

When a certain moisture content is to be obtained, two kinds are mixed, of which one has a very high and the other a very low water content.

Blending should be done very carefully, for sometimes a minute amount of inferior honey (for instance, tobacco honey containing volatile oils that give it an unpleasant aroma and flavour) may spoil a large quantity of superior honey. That is why it is advisable to go by the little-bitterness-spoils-much-sweetness principle and first add the "improver" to a small quantity of inferior honey and test the result.

HONEY BREAD

It was noticed long ago that honey cakes were highly nourishing and remained fresh even if kept for a long time. In our experiments we decided to use the remarkable property of honey—retention of moisture in bread—to prepare a bread that would keep well and be highly nutritious. We baked samples of rye and wheat bread to which were added different quantities of honey.

Finally we succeeded in obtaining a kind of honey bread which contained proteins, fats, carbo-hydrates, mineral salts and vitamins.

This bread has a very pleasant taste and quickly appeases hunger. That is why it is convenient and well-suited for tourists, mountain-climbers, athletes and so on.

Honey added to a dough containing fats, proteins and other substances preserves these substances from spoilage in the baked bread.

Table 7 shows the results of a chemical analysis of eight samples of honey bread, made at the Kiev Research Institute of Dietetics.

Table 7

Chemical Composition of Honey Bread

No. of sample	Moisture %	Nitrogenic substances %	Mineral substances %	Fat %	Total amount of reducing sugars %	Total amount of carbohydrates %	Caloricity of 1 kg of bread	Acidity	Remarks
1.	18.7	5.2	0.56	2.10	35.90	72.44	3,419.5	6.9°	After 10 days
2.	27.6	7.6	0.50	1.00	24.70	63.30	2,999.9	3.8°	of storage in
3.	29.3	12.3	0.91	0.40	31.10	57.10	2,882.4	3.9°	the laborato-
4.	24.2	9.2	0.76	0.28	31.80	65.56	3,071.1	2.9°	ry, all sam-
5.	22.3	7.5	0.77	1.50	24.40	67.93	3,232.1	3.7°	ples retained
6.	24.4	9.8	0.79	0.82	25.80	64.19	3,109.8	3.0°	their appear-
7.	19.5	7.3	0.55	3.90	35.20	68.75	3,481.3	3.7°	ance, flavour
8.	20.6	7.6	0.48	4.60	33.50	66.92	3,483.1	4.7°	and aroma.

Chapter II

THERAPEUTIC USES OF HONEY

VIEWS OF ANCIENT THINKERS ON THE PROPERTIES OF HONEY

Palaeontologic investigations show that there were bees in the Tertiary Period, i. e., nearly 56 million years before the appearance of man.

The oldest relic depicting the gathering of wild honey by primitive men is the New Stone Age wall painting in Spider Cave, near Valencia. It represents a human figure taking honey from a hole in a cliff with bees circling around.

Bee honey has been a favourite food of all peoples in all ages. Pyramids and obelisks—monuments of ancient Egypt—bear hieroglyphic descriptions of the uses of honey as a food and medicine. The most ancient papyrus in Georg Ebers's collection of papyri on medicine, written 3,500 years ago,* says that honey should be used for wounds and to "induce urination and ease the bowels."

Edwin Smith's medical papyrus, too, contains interesting data on surgery and treatment of wounds, with honey figuring as an important curative agent.

In Hindu mythology bees occupy a place of honour, and Vishnu, personifying the sky and giving life to the

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* From the calendar on the back of the first page, Ebers believes the papyrus to be written in 1553-1550 B.C.

universe, was represented as a bee resting in a lotus blossom.

In ancient India, people attributed to honey many important curative and tonic properties. *Alternation*, the drug which "gave pleasure to man and preserved youth," was made chiefly of honey.

Among the antidotes against mineral, vegetable and animal poisons, honey was considered as the most important.

The *Ayur-Veda* says that human life can be prolonged if a certain diet is kept, the main components of which are milk and honey.

In ancient Greece honey was regarded as the most valuable gift of nature. The Greeks thought their gods were immortal because they ate ambrosia which was supposed to contain honey. So they offered their gods fruits covered with honey as sacrifice.

Nine centuries before our era, great Homer sang praises to honey and its excellent qualities in his immortal *Iliad* and *Odyssey*. In *Iliad* he describes in detail how Agameda prepared a refreshing honey drink for Greek warriors.

Pythagoras, the father of mathematics, asserted that he lived to be ninety thanks to eating honey. Pythagoras and the Pythagoreans lived on a vegetarian diet and honey.

Ovid, the Roman poet who lived after Pythagoras, said that men should eat pure milk and fragrant combs filled with thyme-smelling honey.

Democritus, who developed the atomistic theory, always ate honey with his food and lived for more than a hundred years. When asked for advice on how to preserve health, he said that people should eat honey and rub their skin with oil.

That shows what keen observers Democritus and other ancient thinkers were, for oil is the best remedy for dry skin, which usually leads to peeling and chapping. Rubbing the skin with oil not only softens it but also removes dust and microbes.

Hippocrates,* the great physician and thinker of antiquity who lived about 2,500 years ago, ate honey constantly and used it in his medical practice as a remedy against many diseases. He said that in combination with other foods, honey was nourishing and health-giving. He lived to the ripe old age of 107.

Aristotle, the father of natural science, was well grounded in medicine. He maintained that honey had special properties that enhanced people's health and prolonged life.

Honey and mead were favourites with the Greek lyric poet Anacreon. He lived to be 115 years old.

At a supper given to celebrate the 100th birthday of Pollius Romillius, a Roman senator, Julius Caesar asked him to what he owed his bodily and mental health. The reply was: "Honey within and oil without."

Pliny, the author of the monumental *Natural History*, pointed out that honey possesses excellent curative properties and is especially effective in the treatment of wounds and abscesses in the mouth.

Dioscorides, a Greek scientist who lived about 2,000 years ago, wrote that honey can be successfully used against intestinal diseases, infected wounds and fistulas.

The famous Greek physician, philosopher, and experimenter Galen considered honey an effective remedy against many diseases. He recommended it for the treatment of various poisonings, intestinal diseases and, particularly, noma.

Ibn-Sina (Avicenna), the great scientist whose 1,000th birthday was celebrated in 1952, recommended honey as a

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* In the second century A. D., the inhabitants of the Cos, Hippocrates's countrymen, were still showing people his tomb near Larissa (Thessaly). A legend has it that a swarm of bees which produced a special kind of honey that was effective against thrush settled on his grave. That started mass pilgrimages by nursing mothers to Hippocrates's grave to obtain this miraculous honey for their babies.

means of prolonging life and preserving the ability to work in old age. He used to say: "If you want to remain young, eat honey." He considered that persons over 45 years old should eat honey regularly, especially with ground walnuts, which are rich in oil.

Thus did great thinkers of ancient times note the remarkable properties of honey as a food and medicine.

In this respect, the treatise on medicine written by the first Russian woman physician Eupraxia-Zoe, daughter of the Grand Duke Mstislav Vladimirovich and granddaughter of Vladimir Monomakh, is noteworthy. In the treatise, which she wrote in Greek in the thirties of the 12th century, she dwells at length on the food value of honey.

HONEY—AN IMPORTANT CURATIVE AGENT OF POPULAR MEDICINE

Medicine is one of the oldest sciences. Thousands of years ago, primitive man who was close to nature began, purely empirically, to use the various forces and gifts of nature as means against diseases.

Observations and folk wisdom have done much to advance medicine. Many drugs, including digitalis, adonis, quinine, opium, atropine, cocaine, have been borrowed from popular medicine. Even such a wonderful drug as penicillin was successfully used in popular medicine many decades ago in the form of green mould.

Hippocrates wrote: "You must not be ashamed to ask common people if something seems useful to you as a remedy, because I think that the art of medicine as a whole was discovered in that way." The famous Russian scientist V. Manassein always said that though many drugs have been evolved by scientists, medicine draws much of its knowledge from the people.

In Russia popular medicine is thought highly of both by the people and by physicians, and has been studied by

S. Botkin, G. Zakharyin, A. Ostroumov, V. Manassein and other prominent scientists. In Soviet years, many effective drugs have been drawn from popular medicine and put into general practice.

In popular medicine, honey, which has been used in the treatment of many diseases since time immemorial, is regarded as an important remedy.

Ancient Russian manuscript medical books offer dozens of prescriptions in which honey is given a prominent place. Honey is prescribed with camomile, nettles, goosefoot, onions, garlic, parsnip, hops, mustard seed, poppy seed, vinegar and so on. Honey is spoken of as a remedy indicated for people of all ages: "Forest honey may be given freely at discretion to the old and young, even to the woman big with child, because it is harmless to the fruit in her womb."

As a wonderful medicine honey is lauded in epic poems, folk songs and tales. Honey was the medicine used by the first folk physicians—wise ancients who had stored a wealth of experience. Epic tales tell us how these ancients cured Ilya Muromets, the legendary knight, who "sat stone-still in the village of Karacharovo for thirty-three years." They "gave him a cup of mead" and he found his former strength returning to him. *Kalevala*, the Karelo-Finnish epic, also gives many vivid instances of cures performed with honey.

The experiments and observations of the past few decades show there is every reason to regard honey as a medicine.

Before examining what the curative properties of honey are due to, let us consider the curative properties of *glucose* or *grape sugar*, the chief constituent of honey. Glucose is widely used in medicine for cardiovascular diseases, hyertension, haemorrhage (particularly gastric), stomach ulcers, children's intestinal diseases, various infectious diseases, such as typhus, dysentery, malaria, sore throat, measles, scarlet fever, and for sepsis. Glucose

is the most effective drug for poisonings. There are many other diseases which are effectively treated with glucose.

In addition to being an excellent food for cells, tissues and organs, glucose increases the glycogen content of the liver, the source of the organism's energy, and improves metabolic processes in the tissues. It acts as a tonic on the cardiovascular system when there is a decreased sugar content of the blood. Glucose increases the body's resistance to infection. In modern therapy, glucose is widely used to intensify the detoxifying activity of the liver.

Since honey, in addition to glucose, contains mineral salts, organic acids and other substances necessary for life, it is clear why it is an excellent therapeutic and prophylactic agent.

USE OF HONEY FOR DIFFERENT DISEASES

TREATMENT OF WOUNDS WITH HONEY

About 2,500 years ago Hippocrates successfully applied honey in the treatment of various diseases, including wounds.

Pliny, the famous Roman scientist and author (23-79 A.D.), wrote that the fat of fish combined with honey is excellent for infected wounds. He also advised the use of honey for abscesses in the mouth.

Avicenna considered that honey had the property of adsorption and recommended the application to external wounds of cakes made of wheat flour and honey without water.

There is evidence in literature that in Russia in the 11th century, wounds were treated with a honey ointment containing tar. Ancient Russian medical books state repeatedly that "honey is very good for fetid wounds."

In later times a combination of honey and cod-liver oil was used in the treatment of significant wounds; this com-

bined dressing was applied to the wounds for ten or eleven days, after which period the wounds healed and dense scars appeared in their place.

Honey and cod-liver oil are used for infected wounds Y. Krinitsky, a Soviet surgeon, obtained good results in using the application of honey-cod-liver-oil ointment to festering wounds with necrotic surfaces in 48 cases. After five days of treatment the necrotic tissues were detached from the wounds and the epithelium quickly regenerated in 90 per cent of the cases.

He obtained equally good results in the application of this ointment in 37 cases of slowly granulating wounds: in 98 per cent of the cases, abundant granulations appeared on the 3rd or 4th day of treatment.

From his clinical observations, Dr. Krinitsky concluded that honey accelerates healing. He considers that honey, when applied to a wound, sharply increases the glutathione content in the wound secretion; glutathione plays a very important role in the oxidation-reduction processes of the body: it stimulates the growth and division of cells and in this way promotes the healing of wounds (Table 8).

In 1946, Professor S. Smirnov of the Tomsk Medical Institute applied honey for bullet wounds in 75 cases and

Table 8

Increase of Glutathione Content in Wound Secretions with Application of Different Dressings (after Y. Krinitsky)

Medium (Dressing)	Glutathione content in % %	
	Before applying dressing	After applying dressing
Cod-liver oil	45	47
Honey	42	68
Honey and cod-liver oil	39	62

arrived at the conclusion that honey stimulates the growth of tissue in sluggishly healing wounds.

Merited Doctor of the Ukrainian S.S.R. A. Budai used honey for sluggishly healing wounds and ulcers.*

He writes:

"War invalid S., aged 25, had a big scar on the back of his right foot. In the centre of the scar was an ulcer 3 by 5 centimentres with a deep glossy greyish bottom and necrotic thickened edges. The patient said the wound had been in this state for three months. The application of Vishnevsky ointment, phototherapy and other methods gave no effect. Twenty-two days after honey ointment was applied the ulcer healed."

The observations made by various authors give us grounds for stating that honey accelerates the healing of wounds. Dr. A. Gelfman applied ionophoresis (electrophoresis) of honey to slowly healing wounds at a field hospital in 1946. Under observation he had 35 cases of bullet bone fractures, complicated with osteomyelitis, and other sluggishly granulating wounds. He noted that ionophoresis of honey promoted the development of granulations. The wounds covered with flabby and anaemic granulations discharging abundant pus cleared after the application of honey, their blood supply improved and they healed well.

HONEY FOR DISEASES OF THE UPPER RESPIRATORY TRACTS

The therapeutic use of honey in the form of inhalation dates from very early days. This method is particularly effective in the treatment of diseases of the upper respiratory tracts. The observations of Dr. Y. Kizelstein on 20 patients suffering from atrophic processes in the upper respiratory tracts are especially noteworthy. He used an ordinary inhaler pulverizing water solutions; the liquid for

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* The proportion is as follows: bee honey—80 grammes, cod-liver oil—20 grammes, xeroform—3 grammes. Honey and xeroform are ground in the mortar, then cod-liver oil is added and the mass is stirred vigorously.

this was a 10 per cent water solution of honey. Each inhalation séance lasted 5 minutes.

Here are some examples from Dr. Kizelstein's work.

Patient S., aged 30, had for three years been feeling a dryness in the throat and a constant urge to expectorate. Status: the mucous membrane of the posterior surface of the pharynx was dry and covered with thick pus; the same was observed in the throat. After ten inhalation séances the feeling of dryness disappeared, the mucous membrane became moist and secretion of pus ceased.

Patient L., aged 35, had for a long time been suffering from atrophic catarrh of the upper respiratory tracts, with abundant scabs on the mucous membrane of the nose, the posterior surface of the pharynx and the vocal chords. After 15 séances of honey inhalation the patient felt much better; the scabs in the nose, the pharynx and on the vocal chords disappeared completely.

Patient D., aged 50, suffered from ozaena with a typical clinical picture. After 19 séances of honey inhalation, the bad odour became scarcely perceptible, the scabs disappeared, the mucous membrane of the nose became normally vascularized and moist.

Patient S., aged 32, had for several years been suffering from dryness of the throat and at times aphonia. The mucous membrane of the nose and posterior pharyngeal surface showed no particular changes, that of the larynx and the upper parts of the trachea was covered with scabs. After seven séances of honey inhalation the patient felt much better, the scabs disappeared and the voice became clear.

Of 20 cases treated with honey inhalations only two failed to show improvement. Dr. Kizelstein had all these cases under observation for a long time. They had previously been treated by various conservative methods without any noticeable effect.

TREATING COLDS WITH HONEY

We know that honey was used as a medicine against colds in ancient times. There are many families today who buy honey only for this purpose, as it is a favourite home remedy. Honey is a universal remedy for colds not only when used as such, but also in combination with other foods or drugs. Some authors (K. Apinis, S. Kneipp)

recommended honey with warm milk, others (H. Hertwig, Anna Martens) observed a rapid and positive therapeutic effect from honey in combination with lemon juice (the juice of half or one lemon per 100 grammes of honey), still others (A. Oertel, E. Bauer) prescribe honey in warm sweet-clover tea (one table-spoonful honey per cup of sweet-clover tea); D. Svikule and other authors consider a half-and-half combination of horse-radish juice and honey as a potent remedy for colds.

It should be borne in mind that if honey is taken as a medicine against a cold, the patient must keep in bed or at least stay indoors for two or three days, because honey causes excessive perspiration.

HONEY FOR LUNG DISEASES

The use of honey as a remedy against lung diseases has been known from antiquity. Hippocrates wrote that honey potion removed sputum and eased coughing.

The ancient Hindus, too, knew the value of honey as a medicine for lung diseases: The *Ayur-Veda* says that honey with milk is the best remedy against cachexia and consumption.

Avicenna recommended a mixture of honey and rose petals at the initial stages of tuberculosis. He considered that it produced the best effect when it was taken in the morning, before noon.

Ancient manuscript medical books offer many prescriptions, containing honey, against lung diseases.

For centuries, popular medicine has used honey in the treatment of pulmonary tuberculosis in combination either with milk or animal fat. We know that about a hundred years ago people suffering from haemoptysis were given honey, both pure and in combination with carrot or turnip juice.

In his *Popular Medicine as Practised by Armenians in Some Parts of the Transcaucasus*, written at the close of

the last century, S. Zelinsky said that consumptive patients were given honey.

In spite of the aboundant data testifying to the excellent results obtained with honey in cases of tuberculosis, we are not inclined to attribute to it any specific antituberculous properties. What we are certain of is that honey increases the resistance of the whole body and by this means helps it to control the infection.

Our observations of a group of tuberculous patients at the clinic headed by Merited Worker of Science F. Udintsev bear this out. The patients were given 100-150 grammes of honey every day; their condition improved, they gained weight, their cough became less violent, their haemoglobin content increased and the sedimentation rate of blood became slower.

HONEY FOR HEART DISEASES

For centuries, honey has been used for various heart diseases.

Avicenna considered honey an excellent remedy against heart diseases and recommended that a moderate quantity of honey and pomegranate be taken every day by people with heart trouble.

Popular medicine uses honey for cardiac insufficiency, angina pectoris and other diseases.

The myocardium works ceaselessly and must receive glucose to compensate for the loss of energy. This was proved at the International Congress of Physiologists in 1901, where the isolated heart of a warm-blooded animal was shown; a minute quantity of glucose (0.1 per cent) was added to the saline in which the heart was kept, and this enabled it to beat for four days.

Since honey consists for the most part of glucose, its beneficial action on the cardiac muscle is quite understandable.

According to some authors (Professor M. B. Golomb,

A. Raff and others), the daily consumption from 50 to 140 (an average of 70) grammes of honey for one or two months by patients with serious heart diseases brings about a marked improvement in their condition, normalizes their blood composition, increases the haemoglobin content and the cardiovascular tonus.

Honey was included in the diet of some patients suffering from various diseases with signs of cardiovascular insufficiency; this provided optimal conditions for the nutrition of the myocardium.

Honey should be included in the everyday diet of patients with heart weakness.

HONEY FOR GASTRIC AND INTESTINAL DISEASES

Folk wisdom says that "honey is the stomach's best friend."

Numerous data in literature show that honey helps digestion. The explanation is that the manganese and iron contained in honey facilitate the digestive process and the assimilation of food.

Some authors hold that honey is a good remedy against constipation.

Food stays in the stomach for two, three and more hours, where it is acted upon by the gastric juice.

We were interested in the influence of honey on gastric juice secretion. Our observations were conducted on a group of healthy persons and two groups of patients suffering from gastritis with increased and with decreased acidity.

Upon studying the secretory activity of the empty stomach without the use of stimulants, the persons we had under observation after a few days' rest were given stimulants in the shape of alcohol in various dilutions as well as solutions of linden honey and milk honey No. 60.

We found that linden honey and milk honey No. 60 decreased the secretion of the gastric juice and its total

acidity. In cases of achlorhydria, however, the solution of honey No. 60 caused a slightly increased acidity.

On the basis of clinical observations, a number of authors have come to the conclusion that a diet exclusively of honey or of honey combined with some of the basic foods decreases acidity in patients with high gastric acidity. Honey, therefore, may be prescribed as a remedy for various gastric and intestinal disturbances accompanied by increased acidity.

V. Grigoryev attended a patient suffering from gastritis with increased acidity who had attacks of such acute pain that they were accompanied by loss of consciousness. Honey proved to be the only effective remedy for that patient.

The clinical observations of Professor N. Müller, Dr. Z. Arkhipova, Professor F. Menshikov and Dr. S. Feldman show that honey is a valuable dietetic food for persons suffering from gastric and duodenal ulcers: the pains, heartburn and nausea disappear and the haemoglobin content increases.

In cases of gastric and duodenal ulcers, honey should be taken an hour and a half or two hours before a meal, or three hours after. The best time is an hour and a half or two hours before breakfast and dinner and three hours after supper. Excellent results are obtained when honey is taken in a glassful of warm boiled water.

Honey may also be prescribed for patients with decreased acidity of the gastric juice. If honey is taken an hour and a half or two hours before a meal it inhibits the secretion of the gastric juice, and if taken immediately before a meal, it stimulates its secretion.

Honey diluted in warm water facilitates the liquefaction of gastric mucus, causes quick absorption without irritating the intestine, and a decrease of acidity. A cold water solution of honey delays the emptying of the stomach and irritates the intestine.

Academician K. Bykov, who studied the influence of

various stimulants on gastric secretion, found that when the animals he was experimenting on were given honey the secretion was alkaline or slightly acid. This phenomenon was so pronounced that he was inclined to look for its cause in some disturbances or lesions of the mucous membrane of the small stomach. Nothing, however, was discovered. If honey was not given for several days the animal's gastric secretion became normal. Academician Bykov arrived at the conclusion that "there is no doubt that an inadequate but, according to accepted opinion, absolutely harmless stimulant proved to be the cause of a most profound functional disturbance of the secretory process."

Professor N. Müller and Dr. Z. Arkhipova checked the effect of honey on gastric and duodenal ulcer at the Department of Dietetics of the Ostroumov Hospital in Moscow. A hundred and fifty-five patients suffering from gastric ulcer were given honey. The observations showed that honey regulates the acidity and quantity of the gastric juice and favourably influences such symptoms as heartburn and eructation, which disappeared in 111 cases out of 113; of the 111 cases, 101 were freed from pains, 8 felt their pains weaken and only 2 felt no change. Before the honey treatment was started, 68 patients had had normal stool and 47 had constipation; after the treatment, 107 patients had normal stool and 8 had constipation. The treatment resulted in 11 patients gaining one kilogramme, 32 patients—from one to two kilogrammes, 31 patients—from two to three kilogrammes, 22 patients—from three to four kilogrammes, and 9 patients—four and more kilogrammes; only two patients gained no weight.

Cases of gastric and duodenal ulcer were treated with honey for three years at the therapeutic clinic of the Kursk Medical Institute (Professor F. Menshikov and Dr. S. Feldman). Of 46 cases, 18 were in-patients and 28 out-patients. Honey treatment produced a demonstrative and positive effect; the pains disappeared soon after the treatment was

started, the stool became normal, the appetite improved, the gastric secretion and its acidity decreased, and the patients put on weight; the haemoglobin content increased by 6 to 15 points (on the average—12 points), the mean increase in the number of red corpuscles was 600,000, while the number of leucocytes also increased noticeably. Monthly, the in-patients put on an average of 2.8 kilogrammes, and the out-patients—an average of 2.2 kilogrammes. In 28 patients honey reduced total acidity by 10-22 per cent and the free hydrochloric acid content by 10-16 per cent. Roentgenoscopic investigation showed the presence of a niche in the stomach of 14 in-patients; after four weeks of honey treatment it disappeared in 10 cases. The niches disappeared in 10 out of 14 out-patients after treatment lasting from four to six weeks.

Fifty-seven cases of gastric and duodenal ulcer were treated with honey by Dr. V. Semenova under the guidance of Professor I. Levinson at Basmannaya Hospital in Moscow. Twenty-nine patients received only honey and twenty-eight—honey in combination with other drugs. The treatment resulted in freeing all the patients from pains, in a decrease of the acidity of the gastric juice, cessation of gastric haemorrhage, normalization of the stool and disappearance of the niches.

Similar results were obtained at the Moscow Garrison Hospital by Army Physician Major D. Grosman, who treated eleven patients suffering from gastric and duodenal ulcers with honey in combination with other drugs. Eructation and nausea disappeared, gastric haemorrhage stopped and acidity of the gastric juice was reduced to normal.

Honey proved effective in the treatment of 11 patients with gastric and duodenal ulcer at the Second City Hospital in Moscow.

Extremely valuable observations were made at the therapeutic clinic of the Irkutsk Medical Institute where 600 patients with gastric and duodenal ulcer were treated with honey in the period between 1944 and 1949.

M. Khotkina submitted a dissertation describing 302 cases with a pronounced, typical picture of the disease. The ulcer cases were 253 (85.4 per cent) men and 49 (14.6 per cent) women. Seventy-six patients (34.3 per cent) had increased acidity, 67 (30.2 per cent) had normal acidity, 54 (24.7 per cent) had decreased acidity and 24 (10.8 per cent) had achlorhydria.

The observations showed that while the usual dietetic and conservative methods of treatment proved effective in 61 per cent of the cases and failed to lower the pain in 18 per cent, honey treatment yielded positive results in 79.7-84.2 per cent of the cases and only 5.9 per cent continued to have pains at the end of the course of treatment. Roentgenoscopic investigation showed that the niches disappeared (the ulcers healed) in 29 per cent of the cases treated with usual methods and in 59.2 per cent treated with honey. The average time of staying at the hospital was shorter when honey was employed.

Honey, it was noted, acted as a general tonic: the patients put on weight, their blood improved, the acidity of the gastric juice became normal, the excitability of the nervous system became less pronounced. The patients became composed and more cheerful.

Thus, both popular medicine and modern clinical experience show that honey is an excellent remedy against gastric and duodenal ulcer.

In order to follow the progress of honey along the intestinal tract and to elucidate its influence on the peristalsis in healthy people and in people struck down by illness, we made a series of roentgenologic investigations.

In the first investigation the patients were given barium (suspension of the white powder of barium sulphate in water); in the second, two days later, the barium was carefully mixed with 100 grammes of linden honey; in the third experiment it was mixed with 100 grammes of milk honey No. 60; and in the fourth—with 75 grammes of sugar (the equivalent of the sugar content of honey).

These investigations showed that barium combined with honey remained in the stomach one or two hours longer than without it. The progress of barium with honey along the small and large intestines in no way differed from its progress without honey or in combination with sugar.

When honey is added to barium, the patients who have to swallow it do not feel the unpleasant taste. Honey, therefore, may be added to barium for X-ray examinations of the digestive tract.

HONEY FOR LIVER DISEASES

Popular medicine makes wide use of honey for treating liver disturbances. Its beneficial influence is due to its chemical and biological composition. It has been established that besides being a food for the cells of tissues, glucose increases the glycogen stores of the liver and intensifies metabolic processes in the tissues.

The liver acts as a filter, detoxifying bacterial toxins, and glycogen intensifies this action, thereby increasing the body's resistance to infection. That is why in clinical medicine glucose, the major constituent of honey, is widely used for intravenous injections. Here are some instances illustrating the effectiveness of honey in the treatment of liver diseases.

Patient S. contracted hepatitis in 1922. Owing to extreme weakness, frequent vomiting and pain in the region of the liver, he was confined to bed, put on a severe diet and given medicamentous treatment. But all this was ineffective. He decided to try honey, a popular remedy. Soon he was cured of jaundice, the pain ceased and he has been well ever since.

Patient L. who had been suffering from cholelithiasis and cholecystitis for a long time freed himself from unbearable pains by eating honey regularly.

Patient A. suffered from hepatitis and was cured of it only by honey.

Honey has lately found clinical use in the treatment of diseases of the liver and the gall ways.

HONEY FOR DISEASES OF THE NERVOUS SYSTEM

The ancient Greeks and Romans considered honey a sedative and a soporific.

Avicenna recommended small doses of honey in cases of insomnia; in his opinion large doses of honey could cause overexcitement of the nervous system.

Ancient Russian manuscript medical books point out that "equal quantities of mustard seed, pyrethrum and ginger, finely ground and mixed with fresh honey and used as a mouth-wash or held in the mouth for some time, will clear the brain of harmful rheums which cause headaches."

To this day, popular medicine frequently prescribes honey against a number of nervous ailments. Clinical observations in recent years likewise confirmed that honey is effective against these diseases.

Some researchers (A. Oertel, E. Bauer, K. Apinis) state that bee honey is an excellent remedy against nervous disturbances: a glass of water with honey dissolved in it taken before going to bed ensures peaceful sleep.

Professor N. Bogolepov and Dr. V. Kiselyova treated two chorea patients exclusively with honey; the results were very satisfactory: insomnia and headaches disappeared and the patients became stronger, less irritable, and even cheerful.

Clinical observations have shown that rapid results are obtained when nervous diseases are treated with a hypertonic (40 per cent) solution of glucose. Usually the patients feel better after the first three injections of glucose: the headache abates, the eyesight improves, etc. The general condition of the patients also improves.

Physicians who have used honey for nervous diseases note its high therapeutic value. That is easily explained, since honey's chief constituent is glucose.

HONEY FOR SKIN DISEASES

For ages honey ointments and honey cakes have been used in popular medicine for the treatment of skin diseases.

Literature (the works of Professor K. Vysotsky, M. Dietrich and others) tells us that back in the 12th century Fevronia, daughter of a beekeeper in the village of Laskovo, used honey to cure people from various ailments, particularly from skin diseases.

Ancient Russian manuscript medical books offer many ways in which to treat skin diseases with honey.

Popular Medicine as Practised in Everyday Life in Different Climes of Russia, a book written by Dr. A. Charukovsky and published more than a century ago, says that "'thick' abscesses, such as occur on the palms or soles, should be treated with honey mixed with flour in the form of a cake."

A. Violin says in his *Chinese Medicine* that carbuncles and painful abscesses are treated with poultices made of wormwood leaves and garlic ground with a few grains of salt, string beans, vinegar and honey.

In 1945, scientific workers of the Dermatology Clinic at the Second Medical Institute in Moscow published an article describing the successful treatment with honey of 27 patients suffering mainly from furuncles and carbuncles.

This article describes a very interesting case: "Combined honey treatment proved remarkably effective in a case of cutaneous tuberculosis on the face with numerous large tubercles on the limbs.... Honey dressings resulted in a quick discharge of the necrotic central cores of the tubercles and intensive cicatrization; in addition to honey dressings, the patient was given 60 grammes of honey daily for 12 days."

Data on the treatment of skin tuberculosis can also be found in old books on popular medicine.

HONEY IN MEDICAL COSMETICS

The aim of medical cosmetics is to preserve a healthy and beautiful skin which, in its turn, protects the whole body against harmful external influences. Honey plays an exceptionally important part in cosmetics; Hippocrates remarked on its ability to preserve the beauty of the complexion. Professor M. Bremener, Professor D. Lass, Dr. M. Polikarpova and other authors recommend honey masks as a means with which to strengthen and soften the skin; the masks are made either of pure honey or of a mixture of honey, egg yolk and sour cream.

The most widespread honey mask is made from 100 grammes of honey (if the honey has crystallized, it should be heated), 25 grammes of alcohol and 25 grammes of water. This is mixed until a uniform mass is obtained. This mass is spread in a thin layer over the face (after it has been cleansed with oil) with cottonwool and allowed to stay on for about 15 minutes. Then the mask is removed with warm water and the dried skin lightly powdered. Masks of honey, yolk and oatmeal, of honey and the white of eggs, and some other honey masks are also widely used.

The honey-yolk-and-oatmeal mask is made of a tea-spoonful of honey, a table-spoonful of oatmeal and one yolk. The honey and oatmeal are added to the beaten yolk and then mixed until a smooth paste is obtained.

The yolk-and-honey mask consists of a tea-spoonful of honey, a tea-spoonful of glycerin and one yolk, mixed well together.

Honey masks are more effective than creams and ointments, because they not only soften but also nourish the skin. Owing to the high hygroscopic properties of honey, it absorbs secretions of the skin, while its inhibitors act as disinfectants.

Honey masks, lotions, creams and ointments make the

skin fresh and smooth and remove wrinkles, irregularities, and so forth.

The following honey mask is recommended by Professor A. Kartamyshev and V. Arnold in cases where the skin is dry:

1. Wash the face with warm water and apply a hot compress;
2. Smear the face with honey or vegetable oil;
3. Cover the face with a thin layer of cottonwool with holes cut for the eyes and the mouth;
4. Spread honey ointment (30 grammes of wheat flour, 20 grammes of water and 50 grammes of honey) on the cottonwool mask and leave it on for 20 minutes;
5. Remove the mask and apply hot compress two or three times in succession; then wash the face with water at room temperature;
6. Light make-up and powder may be applied.

HONEY FOR EYE DISEASES

In ancient Egypt, honey was considered one of the most effective remedies for various eye diseases. The Ebers papyrus mentions that it was successfully used in the treatment of eye diseases. It is interesting that besides a description of how to prepare honey ointment and the method of applying it, there is a note in red paint, stating: "Mark this well, for this is a truly good remedy."

In ancient Russian manuscript medical books one finds mention of quite a few remedies against eye diseases in which honey figures prominently.

In 1846, Professor Hauser wrote that honey was a good therapeutic agent for burns, and in particular, for eye burns. He illustrated this with the following example:

"A man of 33 carrying two pails of hot water tripped over and got so badly scorched that the skin on the right side of his face peeled off, the lids of the right eye became swollen, the conjunctiva became red and caused much pain; on the right side of the neck blisters ap-

peared in several places, everywhere else the skin had peeled off; the right shoulder was very red all over and showed blisters in places; the arm, too, was red.

"The patient felt terrible pains in the face and the eye, and complained of a headache and a buzzing in his ears; he was weak and his pulse was accelerated (95). The burns were covered with honey twice a day... then crusts appeared on them. The swelling of the eyelids decreased, the patient regained the ability to open and shut his eyes and the eyeball could be observed with the reddened conjunctiva in the corner of the eye. Honey treatment was continued and on the sixth day the eyeball cleared completely, the crusts and the thin reddened film of skin on the eyelids fell off and the oedema of the lids subsided. On the 15th day, the patient was discharged from hospital."

In 1898, *The Russian Beekeeper* carried an article by Dr. Giks declaring that honey was an excellent remedy for inflammations of the eyes.

Today, when medicine has at its disposal a number of new drugs, such as sulphanilamides and antibiotics, honey has not lost its importance and in many cases (on the advice of a physician) can be used successfully for eye diseases.

Dr. A. Mikhailov of Sukhumi uses eucalyptus honey* in ointments for inflammations of the eyelids, the conjunctiva and the cornea, ulcerations of the cornea, and some other diseases. Professor N. Pletnyova of the Ophthalmologic Clinic at the Second Moscow Medical Institute obtains good results in the treatment of keratitis (inflammation of the cornea) with honey.

On the advice of Professor E. Fisher of the Ophthalmology Department of the Odessa Regional Clinical Hospital, honey ointments are widely used for various lesions

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* The method of obtaining eucalyptus honey is as follows: fresh leaves of blue gum are chopped and put into a vessel; scalding-hot water is poured over them and the vessel, covered with a lid, is kept in a warm place for 24 hours. The brew then is poured into another vessel and honey (a quarter of the brew) is added to it. Feeders with the sweet brew are put into hives where bees prepare honey from it.

of the cornea. At first honey was used in a 3 per cent sulphidine ointment instead of liquid paraffin. Soon, however, it was noticed that honey was an effective therapeutic agent by itself. By accelerating cicatrization, honey-sulphidine ointment yielded excellent results in the treatment of sluggishly healing ulcerations of the cornea. The application of the ointment brought about a marked improvement in patients suffering from serious forms of keratitis after a 30 per cent solution of albucid-sodium and a sulphidine ointment with paraffin had proved ineffective. Many cases of keratitis and ulceration of the cornea were treated with unadulterated honey with very good results.

Patient D. was admitted to the clinic with a diagnosis of "keratitis" with frequent relapses, old opaque spaces and new lesions on the cornea. Before she was taken to the Ophthalmology Department of the clinic she had for a long time been unsuccessfully treated with various drugs. After honey ointment was applied the new opaque places quickly resolved and the old ones became less dense. After 16 days of treatment her vision improved from 0.4 to 1.0.

Honey was found effective against scrofulous keratitis. Pure honey ointment was successfully used in the same clinic for lime burns of the cornea.

POST-OPERATIVE APPLICATION OF HONEY

After some operations, particularly of the face and jaws, the patient is put on a diet which must contain the necessary amount of calories and help the wound to heal. As the patient is unable to chew and experiences difficulty in swallowing, he is given liquid and mashed food. In such cases honey is irreplaceable because large amounts of it can be eaten without chewing and it helps the wound to heal. Honey can be given in a sweet-brier syrup, in fruit, berry, and vegetable juices. It can be taken in combination with vitamins, proteins, calcium, and so on. Patients are always pleased with a diet containing honey mixed with ground

curds, yolks, cream and so forth. Since honey is a potent antiseptic, the mouth cavity does not have to be disinfected as is absolutely necessary after other foods. Here is an illustration of what has been said above:

Patient A., aged 63, underwent a resection of the larynx with the removal of a malignant tumour in 1949. After the operation he was given food in enemas which caused pain and irritation of the intestines. The patient was put on a diet of honey, which resulted in an alleviation of the pain in the larynx and a quick healing of the wound with the formation of a dense scar. The painful craving for food, which had tortured the patient before, left him. He regained his ability for sound and refreshing sleep. The bowels functioned normally. Soon he was able to eat any food; he was allowed to leave the clinic ahead of time and return to his work. Up to the present, he has been well and continues to work. A medical commission has pronounced him sound and able to work.

THE VALUE OF HONEY IN DIETS FOR INFANTS AND CHILDREN

In the U.S.S.R. everything is being done to have children develop normally, grow strong, healthy and vigorous. Adequate and rational nutrition is a very important factor in the achievement of this task.

We know from literature and personal observations that when children receive honey instead of sugar, the substitution favourably influences their physical development.

Professor V. Skvortsov, member of the U.S.S.R. Academy of Medical Sciences, has furnished a scientific substantiation of this phenomenon. He holds that the remains of sugar in the mouth are decomposed by bacteria, which results in the formation of acids, especially lactic acid. This causes progressive decalcification of the teeth.

Unlike sugar, honey is actively antibiotic and potentially alkaline and, consequently, disinfects the mouth. It may be said that honey favourably influences the teeth. Folk medicine has long advocated the use of a 10 or 15 per cent water solution of honey for rinsing the mouth in case of various diseases of the mouth and pharynx. Medi-

cal science recently started prescribing honey inhalations.

In the past few decades experiments have proved honey's exceptional value as a food and medicine for infants.

Research workers were interested in the problem of the influence of honey on the haemoglobin content in the blood of healthy children. Observations were made at some pediatric institutions, where the diet of children included honey. The haemoglobin content in the blood of one of two brothers, who was not given honey, increased by 4 per cent after a 40 days' stay in the sanatorium, while in the case of the other brother, who received honey, the haemoglobin content increased by 13 per cent. When a child whom we shall call L. was given honey in addition to his normal diet, his haemoglobin content increased by 23 per cent.

Here is what V. Temnov says in his book about a group of 20 children between the ages of three and a half and six who received honey regularly in a kindergarten under the supervision of Dr. Zhukova. Some of the children contracted measles and mumps. "With the children who fell ill during the time they were given honey the diseases took a very mild course and there were no complications. During the six weeks that the children received honey their health improved considerably, they became cheerful and lively, better behaved and slept well. They all put on weight, the average increase after the first two weeks of honey treatment being 2.1 kg. In spite of a hot summer, there were no cases of dysentery or other gastro-intestinal diseases."

The results obtained by Professor M. Golomb are even more convincing. He prescribed honey for the treatment of toxico-infectious diarrhoea in children and found that the course of disease was less severe and that recovery came quicker. His observations, which were conducted at the pediatric clinic of the Medical Institute in Dniepropetrovsk, show that the addition of honey in children's diet not only steps up recovery but also makes the children

gain weight. Moreover, he discovered that sick children who receive honey put on two and a half times more weight than children who undergo the same course of treatment without honey.

In their *Experience in Treating Dysentery with Honey* L. Tretyak and co-workers say that in serious cases of dysentery no noticeable effect is achieved through the application of honey. But in mild cases, honey helps to regulate the stool and favourably influences the general course of the disease. The stools of the patients who received honey showed no blood and in general these patients recovered quicker. Honey treatment lightens the course of chronic dysentery and helps to bring about a quicker recovery.

Clinical observations show that drugs applied in combination with honey produce a good and quick result. This is quite understandable, for recovery is due to the action of both the drugs and the various components of honey.

Literature data assert that in cases of bed-wetting, treatment with glucose yields good results. We investigated the effectiveness of honey in this condition; children were given honey together with their morning and evening meals and many were completely cured of this disease.

For decades popular medicine has been aware of the fact that honey is a better sweetening agent than sugar. A child benefits more from a spoonful of honey than from 20-25 grammes of sugar, because sugar is nothing more than a highly calorific carbo-hydrate while honey is a valuable food which contains important chemical and biological substances. Among other substances, honey contains folic acid whose significance for a growing organism cannot be overestimated, since it improves the composition of the blood by increasing the number of erythrocytes and the haemoglobin content.

Professor P. Risga considers that honey improves the health of weak children as it brings about an increase of

erythrocytes in their blood. The role of honey in the diet of infants is particularly high, especially when they do not get enough mother's milk and have to be given cow's milk. If the milk is sweetened with sugar (beet or cane), the sugar must be split into glucose and levulose before it penetrates into the blood; but honey contains these substances as such and can be assimilated directly.

Another reason why babies should be given honey is that it contains iron, of which little is contained in both mother's and cow's milk. The combination in honey of highly useful sugars—glucose and levulose—with organic acids, essential oils and other important substances is such that it improves the appetite and stimulates digestion.

HONEY FOR EXUDATIVE DIATHESIS

Exudative diathesis is a condition of child organism when it is susceptible to various inflammations of the skin and mucous membranes. As the child grows, the manifestations of exudative diathesis become less frequent; the disease may disappear altogether. But unfavourable conditions (bad hygienic conditions, faulty nutrition, etc.) may result in the reappearance of the disease at a more advanced age and in a more severe form. When exudative diathesis combines with tuberculosis, the disease is known as scrofula.

The mucous membranes, lymph nodes and skin of children affected with diathesis undergo various alterations, such as phlyctenulous conjunctivitis, keratitis, coryza with infiltration of the skin, suppurative otitis and swellings of the lymph nodes which are closely packed and tend to suppurate.

The opinion of some authors that in the case of diathesis certain food-stuffs, for instance, milk, honey and eggs, cause exudative processes, prompted us to study the problem of the influence of honey on children suffering from exudative diathesis.

In the summer of 1950, at a pediatric sanatorium, we experimented on a group of children between 7 and 15 years of age who were given a nourishing diet with the addition of vitamins C, B and A. Sixty children, some of whom were affected with diathesis, regularly received a spoonful of honey in the morning and evening. The diet which included honey proved very beneficial to them.

Here are a few examples to illustrate the influence of honey on children affected with diathesis.

L., nine years old, suffered from diathesis and chronic constipation. Weight was below normal for her age group; the skin and mucous membranes were pallid. The girl was given honey and after a stay of forty days at the sanatorium gained 2.5 kg.; the index of muscle strength increased correspondingly; the haemoglobin content of the blood also increased; the bowels improved as did the girl's general condition.

S., eight years old, had been suffering from diathesis for a long time. Received honey in his diet. A few days after honey had been added to the diet, felt better, the manifestations of diathesis became less pronounced, the haemoglobin content increased by 13 per cent. The child grew stronger and gained weight.

M., nine years old, suffered from diathesis, rickets and involuntary defaecation. The child was put on a diet that included honey and in the course of forty days he grew stronger and gained 2.5 kg.; the haemoglobin content increased by 12 per cent and defaecation ceased. Manifestations of diathesis disappeared.

These examples clearly show that when children are given honey in addition to their normal diet diathesis disappears. Children who were given honey became stronger, gained weight, the haemoglobin content in their blood increased and their general condition greatly improved.

Doubtlessly, honey is much more beneficial for children than sugar, jam or sweets, and its addition to their diet is strongly recommended in cases when carbo-hydrates are not contra-indicated.

HONEY DIET AND THE PROBLEM OF LONGEVITY

The great philosophers and physicians of antiquity attached tremendous importance to honey and considered that it helped to prolong human life.

We are told that when Democritus, the Laughing Philosopher, decided to end his life (Hipparchus says he died at the age of 107) he abstained from food. However, when the feast of Thesmophoria came, he yielded to the entreaties of the women of his household not to die so that they might celebrate the feast. He ordered a vessel of honey to be put before him and by inhaling its aroma prolonged his life for a few days. When the honey was taken away, he died.

Over 100 years ago, Professor N. Vitvitsky wrote in his *Beneficial Influence of Honey on the Human Constitution* that Trembecki, a Polish poet, who had for thirty years lived on a simple diet that included honey and mead, was remarkably hale and hearty at eighty. Vitvitsky's teacher, Mülbacher, who ate honey daily, lived to the age of 120.

In *Beekeeping for Village Schoolmasters* (1910), A. Zubarev says that in the village of Nazyi on the Ladoga Canal there lived a 107-year-old townsman named Timofei who ate chiefly honey.

While studying the influence of work in bee-gardens and of the consumption of honey on healthy and ailing people, we sent a questionnaire to several persons whose age exceeded a hundred, inquiring whether honey had been part of their diet over a prolonged period and whether they had kept bees. The answers showed that many of them believed their longevity was due to their eating honey or to work in the apiary.

Pyotr Shvalev, who lives in Primorye Territory, wrote that he had worked in a bee-garden for 45 years and had never been ill in all that time. His parents, also beekeepers, were alive, and his grandfather, who had kept bees, had never known illness and died "of old age" at 105.

A. Bondarenko of Bryansk Region had never been ill

in all the forty years that he had kept bees. His mother, also a beekeeper, was 108 in 1951, and at the time he wrote she was in perfect health.

How is one to explain the fact that beekeepers and people who eat honey regularly usually enjoy good health and live to an old age? We think this is due to the simultaneous action of several favourable factors, such as the consumption of an excellent food—honey—working in the fresh air and the prophylactic effect of bee stings.

THERAPEUTIC DOSAGE OF HONEY

Although honey is not as potent a drug as opium, morphine or strychnine, yet when it is used against a disease the dose and strict adherence to a routine are of utmost importance.

As a medicine, honey appeals both to adults and children. It can be taken unadulterated and as an ingredient in other foods whose flavour it improves.

For therapeutic purposes, honey is best taken in a water solution, because in this form its components are easily absorbed and reach the blood stream and thence are transported into the tissues and cells of the body. Observations show that the daily optimal dose of honey for an adult is 100 grammes (200 grammes at the most), which should be taken in the following way: 30-60 grammes in the morning, 40-80 grammes at noon and 30-60 grammes in the evening. Honey should be taken either an hour and a half or two hours before or three hours after a meal.

Children should be given a tea-spoonful (about 30 grammes) honey a day.

A course of honey treatment should last for two months.

Honey is an easily soluble and absorbable carbo-hydrate. If the daily dose exceeds the optimal, the organism may become oversaturated with carbo-hydrates, which cannot but interfere with the functioning of the insular

apparatus of the pancreas. We think that in prescribing honey the individual's threshold of carbo-hydrate tolerance should be taken into account and the dosage should be regulated by it. According to Academician A. Palladin, glucose introduced per se into the body with food or formed during digestion is transmitted into the blood from the intestine; other sources of glucose are proteins from which it is produced in the body and glycogen from which glucose is elaborated in the liver. Glucose in its turn is used by the liver and the muscles to form glycogen and for oxidation processes in the tissues with the formation of fats. Owing to these opposite processes the sugar content in the blood under normal conditions remains constant. If for some reason one or the other of these processes is disturbed (for instance, the secretion of insulin decreases) and the sugar level in the blood rises (a phenomenon known as hyperglycaemia), sugar will be secreted in the urine and glycosuria will result.

The observations of various authors and our own prove the inadvisability of using large doses of honey.

IDIOSYNCRASY FOR HONEY

Idiosyncrasy (or allergy) is excessive sensibility of the body to very slight influences or irritations. Some persons are sensitive to foods, for instance, strawberries, eggs or honey, others to various substances, such as iodine, bromide, bee venom, pollens, etc. Increased sensitivity usually manifests itself in perfectly healthy individuals by attacks of a local or systemic nature: a rise of temperature, general indisposition, nausea, dizziness. Idiosyncrasy commonly affects the skin (nettle rash, eczema), the respiratory tract (bronchial asthma, suffocation) and the digestive tract (vomiting, diarrhoea). Some people (most often children) are sensitive to honey. A tea-spoonful of honey induces nettle rash, gastric and intestinal disturbances, etc.

A number of investigators have tried to explain this phenomenon. A. I. Root quotes in his book the opinion of Dr. E. F. Phillips who thinks that the reason certain individuals cannot eat honey is that when it enters the stomach "a strong osmotic action is set up, which means that the honey is extracting moisture from the walls of the stomach.... This is enough in some persons to cause pain." K. Balode and F. Galenieks also say that pure honey taken without other foods extracts great quantities of moisture from the walls of the stomach.

Professor P. Risga says that pure honey sometimes induces cramps; but taken with other solid or liquid foods it has no adverse effect.

Anna Martens observes that some people have an inborn allergy for honey on account of the acids it contains. The above opinions can hardly furnish an exhaustive explanation, because osmosis and the acids are not all that produce an unfavourable effect on some individuals. Indeed, those same persons do not suffer from concentrated solutions of sugar or acid solutions. Besides, we have observed individuals who react strongly to very slight doses of honey dissolved in water or eaten with bread. They get nettle rash, indigestion, etc. Evidently, honey contains substances to which this group of people are allergic. We think that these substances are pollen grains, which have a high protein content.

GLUCOSE AND HONEY

As we have already said, glucose, or grape sugar, is the major constituent of honey. Glucose is produced by plants as a result of photosynthesis and, being a normal component of plants, is of immense importance for plant life.

In 1917, Büdingen proposed intravenous injections of glucose for heart troubles so as to increase the heart's contractibility. For forty years now glucose, an excellent

source of energy and remarkable drug, has been successfully used in all branches of medicine.

Professor F. Udintsev established (in 1929) that 10 to 20 ml. of a 50 per cent solution of glucose introduced intravenously inhibits gastric secretion.

V. Balaban, D. Kaganova and F. Krainovskaya successfully applied glucose in 1937 for intestinal diseases in children.

M. Cherkassky used glucose (in 1938) in the treatment of gastric and duodenal ulcer with good results. Glucose is widely applied and has proved highly effective in the treatment of typhoid fever, dysentery, typhus, quinsy (catarrhal, follicular, phlegmonous and other forms), sepsis and other infectious diseases. It produces an excellent therapeutic effect even in such serious diseases as the toxic form of pneumonia complicating measles as was proved by A. Dobrokhotova in 1940.

Professor N. Savitsky wrote in 1939: "Vulfovich's observations of heart patients in my clinic show that the introduction of glucose decreases the difference in the oxygenation of arteries and veins and improves disturbances connected with anoxaemia."

In 1946, Professor G. Gurevich-Ilyin of the First Moscow Medical Institute drew up a list of indications for the use of glucose; it includes heart failure, arrhythmia, hypertension, cardiosclerosis, anosarca (oedematous condition of the entire body), oedema of cardiac or renal origin, lung oedema; glucose can be used as a diuretic, a relaxant for vascular spasms, a tonic; at the same time it is an antitoxic agent in toxic diseases, infections and intoxications, and a haemostatic, particularly for gastric haemorrhages, when it is introduced in as large a quantity as 100 ml.

Prof. G. Lang stated in 1950 that "intravenous injection of a hypertonic (40 per cent) solution of glucose (grape sugar or dextrose) is effective in cases of hypertonic encephalopathy."

Even this far from complete enumeration of diseases and pathological conditions in which glucose proves to be an effective therapeutic agent is enough to show that glucose has an exceptionally wide therapeutic application.

Glucose is one of the medicines which can be taken internally or injected directly into the blood. But honey is not glucose alone—it is glucose plus mineral salts, enzymes, organic acids, vitamins and many other important substances. Besides, mineral salts here are present in organic compounds with proteins, glucose and other valuable components, possessing great therapeutic value.

It is clear, therefore, that honey is an excellent drug, being at the same time a highly calorific food. Taken perorally, it exercises a beneficial influence on the entire body, raising its defensive power against infections.

COOKING WITH HONEY

Honey is most beneficial when it is eaten either pure or in combination with other foods. Honey adds to the taste of bread, milk, porridges or fruit, and increases their caloricity and assimilability. It can be used instead of sugar in mousses, jellies, fruit stews, vitamin and other beverages. Gingerbread, cakes and bread made with honey are tasteful and are valued higher than the same products made with sugar. Jams and preserves from various fruits and berries, such as cranberry, mountain ash, prunes, are also tasteful when prepared with honey.

Below we offer some recipes of common foods cooked with honey.

Quince is not eaten raw because of its astringent flavour, but is widely used for jams, preserves, jellies, fruit stews and the like. Cooked with honey, quince has a delicious aroma and flavour. Quince preserves with honey are made in the following way: the fruits are pared, cut in two, the core is removed, the halves are then chopped, put into a casserole, covered over with cold water and cooked until

they become soft. The pieces are then taken out and the juice strained. Two parts of honey to one part of the fruit is put into the preserving pan, one or one and a half glasses of the juice is added and boiled to obtain syrup. When the syrup is boiling, the pieces of quince are put into it and left to simmer until they become transparent.

Pancakes with honey. Well roasted pancakes, dipped into butter and honey, are a delicious dish.

Red bilberry preserves cooked with honey. Red bilberries (1 kilogramme), cleaned of leaves, twigs, etc., are put on a sieve, then boiling water is poured over them and allowed to drain off. The berries with three cloves and a piece of cinnamon are then put in a preserving pan, covered with a kilogramme of honey and cooked until ready. When cooled, the preserves are put in a glass jar, covered with oil-paper, tied with a string and stored in a dry and cold place. The preserves can be served as a dessert or as dressing to fried fowl, game, veal, mutton or beef.

Preserves made of cranberry, apples and walnuts with honey. A kilogramme of cranberries cleaned of leaves and twigs and washed is put into a pan containing half a glass of water, covered with a lid and boiled until the berries are soft. They are then mashed and run through a horsehair sieve. Three kilogrammes of honey is boiled in an enamel preserving pan, then the mashed berries, a kilogramme of chopped apples without the cores and a glass of walnut kernels are put into the kettle and cooked for about an hour.

Jelly-preserves of apples and honey. A kilogramme of washed apples without the cores are chopped, put into a pan, covered with two and a half glasses of water and boiled slowly for 30 minutes. The apples then are put on a sieve to allow the juice to drain off. Six hundred grammes of honey is then added to the juice and put to boil over a low fire and skimmed. When cooled syrup drops from the spoon, the jelly is ready. It should at once be poured into warmed glass jars, covered with oil-paper and stored in a cool place.

Honey and sweet-brier vitamin beverage. Although the sweet-brier belongs to the same genus as the rose, it is inferior in beauty and fragrance. Still, a bright green bush of sweet-brier spangled with beautiful pink flowers always evokes our admiration and it is always with pleasure that we fill our breasts with air laden with the fragrance of the "wild rose." The numerous and varied medicinal properties of sweet-brier were known in ancient times. Its berries are rich in vitamin C, precursor of vitamin A (carotene), vitamin B_2 (riboflavin), vitamin P (citrin) and vitamin K, while the seeds contain vitamin E. The berries of sweet-brier are, therefore, a natural concentrate of vitamins; besides, they are rich in sugar, citric acid, mineral salts and tanning substances.

A table-spoonful of well-dried, washed and slightly mashed brier berries is put into an enamel casserole, covered with a glass of boiling water and boiled for ten minutes. The juice and the berries are poured into a glass vessel, covered with a piece of cheese-cloth and left in a warm place for 10 to 12 hours, then strained through two thicknesses of cheese-cloth and the berries are pressed. A table-spoon of honey is added to the aromatic, somewhat acid beverage, and stirred well. The ready beverage should be drunk within 12 to 24 hours after preparation, while the vitamin C is not decomposed. A grown person may drink two glasses of the beverage a day, and a child—one glass.

Whipped egg with honey is a pleasant and highly nourishing food. There are several methods of preparing it.

1. Two table-spoonfuls of honey, a pinch of salt, and a dash of grated nutmeg are added to one whipped egg; this is stirred vigorously, then three quarters of a glass of boiled milk is added and the mixture is strained.

2. Two egg yolks are mixed with three table-spoonfuls of honey; a pinch of salt and a little vanilla powder are added, then a glass and a half of boiled milk is poured in, and the mixture is stirred and strained.

3. Two yolks are whipped, three table-spoonfuls of honey and a glass and a half of boiled milk are added. This is stirred and strained and combined with whipped egg whites.

4. Two egg yolks are vigorously whipped until a yellow mass is obtained, to which 5 table-spoonfuls of honey, half a glass of strawberry juice and a pinch of salt are added. After stirring well, two glasses of cold boiled milk and half a glass of cold boiled water are poured in and the mixture is poured into the whipped egg whites.

5. One egg, three table-spoonfuls of honey, and a table-spoon of orange or lemon juice are added to a glass of cold boiled milk. Then all this is whipped until a uniform thick mass is obtained.

A table-spoonful of honey added to buckwheat, millet, wheat, semolina or any other porridge improves the flavour and increases the caloricity of the food. Honey goes very well with all kinds of baked puddings—semolina, wheat, rice, barley, oat—as well as with pancakes, fritters, etc.

Mustard with honey. Mustard prepared with honey has a particularly pleasant flavour and can preserve its colour and humidity for months. It is very simple to make: add honey (preferably buckwheat) to ordinary table mustard to taste, a little sunflower-seed oil, vinegar and ground black pepper.

Honey mousse. The yolks of four eggs are separated from the whites. The yolks are whipped and a glass of honey is gradually added to them. The mass is then put over a slow fire and stirred constantly until it becomes thick. The cooked mass is added to whipped egg whites, and then the mixture is put in saucers. Whipped cream can be used (three quarters of a glass to four yolks) instead of whites.

Honey lemonade can be made at home in the following way: to have a glass of lemonade, a tea-spoonful of lemon juice is well mixed with two table-spoonfuls of honey and then diluted with boiled water.

Honey orange beverage with cream is prepared from a whipped egg yolk with six table-spoonfuls of honey and one glass of orange juice, well mixed together, with an addition of cream.

Honey strawberry beverage. A glass and a half of milk, two table-spoonfuls of honey and half a glass of mashed strawberries are first mixed together, then, after the addition of a pinch of salt, whipped to obtain a uniform mass.

Honey orange beverage. A glass and a half of milk and half a glass of orange juice are mixed together, then three table-spoonfuls of honey are added and the mixture is whipped.

Honey raspberry beverage. Two table-spoonfuls of raspberry juice and a table-spoonful of honey are poured into a glass of milk, stirred and diluted with water.

Honey cherry beverage. Half a glass of cherry juice is mixed with a table-spoonful of lemon juice, then two table-spoonfuls of honey and a pinch of salt are added and the mixture is stirred in a glass and a half of milk.

Honey cranberry beverage. Three table-spoonfuls of cranberry juice are poured into a glass of boiled water, then a table-spoonful of honey is added and mixed well.

All honey beverages are more delectable when they are cooled.

Milk and honey. The combination of honey and milk is an important item of rational diet and an effective remedy against various diseases; it is extremely important in diets for children.

Pearl-barley milk soup with honey. A thick gruel is made of three table-spoonfuls of washed pearl-barley and water and cooked for 40-50 minutes until almost ready; three glasses of milk, a pinch of salt and a table-spoonful of honey and the same amount of butter are added and cooking continues for another 15 minutes.

Rice milk soup with honey. A quarter glass of well-washed rice is put into three glasses of boiling milk with a pinch of salt and a table-spoonful of honey and cooked

for 30 minutes. When the soup is ready, half a tea-spoonful of butter is added.

Noodles with milk and honey. Fifty grammes of noodles with a pinch of salt and a table-spoonful of honey are put into three glasses of boiling milk and cooked for 20 minutes until the noodles are soft. A table-spoonful of butter is added when the soup is ready.

Apples soaked in honey water. Washed apples are put into a barrel and honey water is poured over them. The water is prepared in the following way: six hundred grammes of honey and three table-spoonfuls of salt are added to 10 litres of water, boiled and cooled. Soaked apples are ready in four or six weeks.

HONEY IN COMBINATION WITH MEDICINAL PLANTS

The following is an alphabetic list of common medicinal plants that are used in combination with honey.

Agrimony (Agrimonia eupatoria L.) is known in popular medicine to possess many-sided therapeutic properties, and is used for rheumatism, haemorrhoids, gastric and other diseases. A. Oertel and E. Bauer recommend taking agrimony tea with honey (a small cup three times a day) perorally or using it as a lotion. Agrimony honey tea is indicated in cases of persistent rheumatic fever, haemoptysis, indigestion, laryngitis; it is highly effective in liver and spleen diseases, as it exercises a laxative action in cases of constipation and intestinal paresis and dissolves renal concrements, thus facilitating their removal with urine; it also proves effective against cancroids (cancer-like tumours of a more benign course).

Aloe (Aloe Mill.) The condensed juice of the leaves of the plant, mostly of the *Aloe frox. Mill.* variety, is used for medicinal purposes. It is of a dark-brown colour and has a specific unpleasant odour and a bitter taste. The following recipe of popular medicine is widely used against pulmonary tuberculosis:

Honey	100.0
Butter	100.0
Lard (or goose fat)	100.0
Fresh aloe juice	15.0
Cocoa (powder)	100.0

This is taken in a dose of one table-spoonful in a glass of hot milk twice a day (morning and evening).

Blackthorn (Prunus spinosa L). In popular medicine, blackthorn blossoms have the reputation of being a mild laxative. A. Oertel and E. Bauer consider the brew of blackthorn flowers with honey a valuable drug in catarrhal conditions of the respiratory tract, because it acts as an expectorant. The recipe is: one table-spoonful of blackthorn flowers is boiled for one minute in 250 grammes of water, then the brew is strained, combined with honey and again boiled. One cup of the brew suffices for one day; it should be sipped slowly.

Clover (Trifolium pratense L.). The brew of clover heads is used in popular medicine as an expectorant and diuretic, and also in poultices for burns and boils. D. Svikule states that clover tea with honey is a good remedy for bronchitis, asthma and can be used as an expectorant and diuretic. The tea is drunk warm.

Coltsfoot (Tussilago farfara L.). The leaves and flowers of coltsfoot are widely used for preparing expectorant tea and brew. The ancient Romans attributed medicinal properties to the plant and used it against coughs, which is seen from its Latin name, *Tussilago*, derived from *tussis*—cough. The leaves of coltsfoot contain a bitter glucoside, tussilagin, gallic acid, inulin, an essential oil, mucilaginous, tanning and other substances.

The Pharmacological Committee of the Scientific Council at the U.S.S.R. Ministry of Public Health has licensed the production of the following drugs from coltsfoot: *Sudorific Tea No. 2* made of two parts of coltsfoot leaves, two parts of dried raspberries, and one part of marjoram; *Lung Tea No. 1* made of two parts of coltsfoot leaves, two parts of the root of marsh mallow and one part of marjoram.

Popular medicine prescribes both fresh juice and brew of coltsfoot leaves (15 grammes to 200 grammes of water) with honey as an expectorant. Many authors state that coltsfoot is more effective in combination with honey. A. Raff advises coltsfoot tea with honey for lung tuberculosis (consumption)—one cup a day. A. Oertel and E. Bauer hold that two cups a day of tea prepared from coltsfoot leaves and flowers with honey favourably influence the nervous system and the intestinal tract, and act as a tonic. Fresh coltsfoot juice with honey and milk is equally effective. K. Apinis recommends the following recipe: 15 grammes of coltsfoot flowers and roots boiled in 500 grammes of water for six minutes; 90 grammes of sage and 120 grammes of centaury steeped in four litres of boiling water; the latter is strained and combined with the coltsfoot tea and honey and drunk 5 or 6 times a day. This is a very effective cough medicine.

Elder (Sambucus nigra L.). Elder blossoms and berries are used for medicinal purposes. Elder flower tea is a good diaphoretic; fresh berries are used as a remedy against rheumatic fever and neuralgia, while the bark is a strong diuretic. Elder contains tanning substances, proteins, malic, valerianic and acetic acids, wax, resin and other sub-

stances. Elder flower tea with honey should be taken in doses of half a glass in the morning and in the evening for four weeks. Its recipe is: one or one and a half table-spoonfuls of elder flowers infused in a glass of water is combined with a spoonful of honey and taken in a dose of one table-spoonful five times a day. Honey tea is considered a good sudorific and should be taken in cases of feverish conditions, influenza and rheumatic fever.

Another recipe: 15 grammes of elder flowers, 15 grammes of peppermint, 15 grammes of milfoil and a little grated ginger are boiled in one and a half litres of water over a slow fire. The brew is strained and taken with honey (one table-spoonful of honey to a glass of tea), half a glass at a time, six times a day in cases of abdominal pains.

Elder flower tea (2 table-spoonfuls of flowers to half a litre of water) with honey should be taken for cough and fevers, three to five cups a day. Brew made from seven or eight elder leaves cut into small pieces and brewed in a glass of water with honey and sage should be taken for haemorrhoids for four or five weeks, half a cup a day. Elder flowers contain malic, valerianic, tartaric acids, choline, an essential oil, sugar, astringent and dyeing substances and a hormonal substance stimulating the endocrine glands.

Elecampane (Inula helenium L.). The roots of elecampane are widely used both in popular and scientific medicine as a diuretic and expectorant.

A. Raff says a cup of elecampane root tea with honey (one table-spoonful of honey to a glass of the tea) taken in the morning and evening is a good remedy against bronchitis and violent coughing. He found that a brew of ground elecampane root (one table-spoonful of the root to a glass of water, boiled for 10 minutes) and honey (a table-spoonful of honey to a glass of the brew) taken in a dose of one table-spoonful three times a day produces a good therapeutic result. The brew should be drunk an hour before meals, and after taking it the patient must lie on his right side for fifteen minutes.

Eucommia. A brew of eucommia bark is widely used in Abkhasian popular medicine for cardiosclerosis.

Experiments with cats and rabbits have proved that eucommia extracts and infusions introduced intravenously decrease the blood pressure. Further observations of patients at the Institute of Experimental and Clinical Therapy of the U.S.S.R. Academy of Medical Sciences have confirmed the experimental findings. Eucommia tincture with honey (20 drops of tincture to a tea-spoonful of honey) administered twice a day lowered the blood pressure in cases of hypertension.

Lemon (Citrus medica L.). Lemon juice with honey is effective in hypertension and various other diseases. Raff advises nervous persons

to drink the juice of half a lemon with a table-spoonful of honey diluted in a glass of boiled water every day. This drink exercises a wonderful action and ensures normal sleep. H. Hertwig recommends lemon juice with honey for laryngitis. K. Apinis states that a mixture of lemon and apple juice with honey is highly effective for colds. A. Oertel and E. Bauer recommend lemon juice with honey and olive oil for liver and gall-bladder diseases.

Linden (Tilia L.). The varieties used for medicinal purposes are *Tilia cordifolia Mill.-T. parvifolia Ehrh.* and *Tilia cordifolia Bess.-T. platyphylla Scop.,* which are listed in the U.S.S.R. State Pharmacopoeia. Linden blossoms are a famous old remedy of popular medicine.

The Pharmacological Committee of the Scientific Council at the U.S.S.R. Ministry of Public Health has licensed the production of *Sudorific Tea No. 1* containing linden blossoms and dried raspberries in equal proportions; *Gargle No. 1* containing one part of linden blossoms and two parts of oak bark; *Gargle No. 2* containing two parts of linden blossoms and three parts of camomile.

Some authors recommend linden-blossom tea with honey for various diseases. A. Oertel and E. Bauer state that a cup a day of linden tea with honey is good for old people as it "purifies the lungs of sputum," and is effective for pulmonary and renal diseases. D. Svikule considers linden tea with honey and wine effective in cases of anaemia; it gives women with greenish-pale faces fresh complexions. H. Hertwig recommends linden tea with honey as a drink for measles patients. He also advises persons with convulsive cough and influenza patients to take a cup of linden tea with honey twice a day.

Lungwort (Pulmonaria officinalis L.). Lungwort is used in popular medicine as an astringent. A. Raff advises boiling 20 or 30 leaves of lungwort, some honey and a handful of wheat bran in 1.25 litres of dark beer until half of the liquid is left. The brew should then be strained, bottled and drunk before meals by lung patients. A. Oertel and E. Bauer say a tea of dried lungwort leaves, plantain, sage, centaury and wormwood with honey is an excellent drug for bronchitis, sore throat, bladder troubles, haemorrhoids, etc.

Marsh mallow (Althaea officinalis L.). Records showing the medicinal properties of marsh mallow date back to antiquity. More than 2,000 years ago, the Greeks named it *Althaea*, which means "healer." Avicenna speaks highly of the plant.

Marsh mallow is known today to possess many-sided curative properties: it is successfully used for inflammation of the urinary ways, of the respiratory organs, and also for diarrhoea. A table-spoonful of marsh-mallow tea (a table-spoonful of blossoms to a glass of wa-

ter) with honey should be taken several times a day in cases of inflammation of the respiratory or of urinary ways.

The Pharmacological Committee of the Scientific Council at the U.S.S.R. Ministry of Public Health has approved *Pulmonary Tea No. 4*, which includes two parts of marsh-mallow root, two parts of colts-foot leaves and one part of marjoram. This tea is very effective when taken with honey (one table-spoonful of honey to a glass of tea) because honey intensifies its therapeutic action.

Mustard (Sinapis). A brew of mustard seed, honey and lily blossoms is good for removing freckles. K. Apinis states that the brew removes freckles and dark spots on the face and makes the skin soft and delicate. Honey dabbed into the skin makes it soft and elastic, prevents the evaporation of moisture and protects wounds from invasion by micro-organisms.

Nettle (Urtica diotica L.). For nearly four centuries popular medicine has recommended the internal use of nettle for uterine, intestinal, pulmonary and haemorrhoid haemorrhages. The discovery of vitamin K in nettle, in addition to vitamins C and A (carotene), explains its haemostatic properties.

Professor A. Tomilin writes: "It has been proved experimentally that for its property to restore haemoglobin and increase the number of red corpuscles, nettle is in no way inferior to iron preparations and that it strongly influences carbo-hydrate metabolism. Popular medicine has for centuries used nettle as a haemostatic agent, also against jaundice, rheumatic fever ... and night sweats of consumptive patients. French doctors say that nettle is effective against acute and chronic enteritis and diarrhoea of tuberculous patients."

In popular medicine nettle is regarded as an important drug with numerous therapeutic properties. It is prescribed in the form of fresh juice, infusions, extracts and leaf tea. Raff recommends nettle tea with honey for haemorrhoids and emphasizes that haemorrhoid patients should be given honey for long periods of time.

Oak (Quercus robur L.). Oak acorns, bark and leaves are used for medicinal purposes. Oak bark (*Cortex Quercus*) contains about 20 per cent of tanning substances and is widely used in astringent gargles, for gingivitis, stomatitis, etc.

K. Apinis states that tea made from oak leaves, acorns and bark with honey is a good remedy for lung, stomach and liver diseases. Honey intensifies the medicinal action of oak tea. A. Oertel and E. Bauer recommend tea made from oak bark and acorns with honey for scrofula.

Onion (Allium cepa L.). Onion, especially in combination with honey, was used as a drug as far back as in the days of Hippocrates. Avicenna noted its high bactericidal properties. Today onion is considered

a drug for various conditions. In 1949, the Pharmacological Committee of the Scientific Council at the U.S.S.R. Ministry of Public Health licensed the production of *Allilcep*, a preparation of ground onion in alcohol. The preparation is successfully used for intestinal disorders (colitis with a tendency to constipation, atony of the intestine) and atherosclerosis with and without hypertension. For violent coughs K. Apinis recommends onion with honey prepared in the following way: 500 grammes of peeled and chopped onions, 50 grammes of honey and 400 grammes of sugar are boiled in a litre of water over a low fire for three hours. The mixture is cooled, bottled and corked. The patient should take from four to six table-spoonfuls a day. A. Raff recommends onion brew or juice with honey as a gargle five to six times a day. Onion with honey (a tea-spoonful every half-hour) prepared in the following way is recommended for heaviness in the chest, cough, hoarseness, and especially for old people: ground onions are steeped in a glass of vinegar, run through a woollen fabric and then mixed with an equal quantity of honey.

A. Oertel and E. Bauer say that raw onion with honey and apples is effective against laryngitis. A mixture of grated onions, apples and honey should be taken daily by people suffering from bladder paresis. A. Raff suggests a table-spoonful of onion brew with honey three times a day as an effective diuretic. For whooping cough he recommends a tea-spoonful of boiled onion juice with honey several times a day.

Dr. V. Lukashevich has successfully used onion in the treatment of cerebral atherosclerosis. K. Apinis gives the formula of an ointment of onion juice, honey, wax and white lily which prevents the appearance of wrinkles and even removes those already present. (For details see page 175).

Plantain (Plantago). Evidence of the curative properties of plantain dates back to antiquity. The ancient Greeks and Romans used plantain seed for dysentery. A thousand years ago, plantain was widely used in Arabian and Persian medicine as a therapeutic agent with many-sided properties. Avicenna recommended plantain seed for skin diseases of children.

Bacillary and amoebic dysentery was treated by Indian physicians with plantain seeds, which are included in the Indian pharmacopoeia. The seeds contain an oil, a mucilaginous substance, proteins, tanning and some other substances.

Plantain leaves (*Folia plantaginis*) are rich in citric acid, potassium, enzymes (invertin and emulsin), precursor of vitamin A (carotene), vitamin C, phytoncides, bitter, tanning and some other substances. They are widely used in popular medicine for cuts, boils, bruises, dermatitis (inflammation of the skin), bronchitis, nephritis.

haemorrhages, etc. An infusion of plantain leaves (six grammes of leaves to 200 grammes of water, a table-spoonful three times a day) is an excellent expectorant.

Professor A. Tomilin says that "French physicians use plantain leaves with good effect in acute and chronic enteritis, dysentery, diarrhoea in tuberculous patients, and chronic nephritis."

D. Svikule recommends the juice of fresh plantain leaves (both *major* and *acutifolia*) with honey as a good remedy for bronchitis, pleuritis exudativa, pulmonary tuberculosis (even with haemoptysis). Another recipe for plantain tea or brew with honey, to be taken in doses of one table-spoonful three times a day, is: six grammes of leaves to 200 grammes of water and 30 grammes of honey.

Radish (Raphanus sativa). A number of authors point out that in combination with honey radish can be used against various diseases. K. Apinis recommends a mixture of one and a half glasses of radish juice, one glass of honey, half a glass of vodka and a table-spoonful of salt as a soothing lotion against rheumatic pains. A. Oertel and E. Bauer state that half a cup to two cups of radish juice with honey a day prevents the formation of stones in the gall-bladder and kidneys; it also acts as a preventive against atherosclerosis, bile concrements and dropsy.

To make good juice, a radish is hollowed out and filled with honey; in three or four hours the juice is ready for use. The dose for adults is two or three table-spoonfuls, and for children—a tea-spoonful every hour. Radish juice with honey is indicated for coughs, hoarseness, and particularly as a good expectorant. Raff recommends a table-spoonful three times a day against coughs.

Raspberry (Rubus idaeus L.). In ancient times dried raspberries were used for fevers, while tea made from raspberry blossoms—as an antidote to snake bites. S. Zemlinsky says that raspberries contain an essential oil, malic and citric acids, sugars, pigments, mucilaginous substances, vitamin C and other substances.

Dried raspberries are used today as a sudorific. Some investigators have used raspberry juice and tea with honey with good results. A. Raff says that raspberry juice with honey refreshes and acts as a tonic for patients suffering from measles. Raspberry tea with honey is indicated for erysipelas. It should be taken warm in a dose of two or three cups a day.

Red bilberry (Vaccinium vitis idaea L.). This is an evergreen shrub of the Ericaceae family growing in coniferous and deciduous forests in the moderate and northern regions of the U.S.S.R., in the Urals and Siberia. Popular medicine makes a wide use of red bilberry leaves, a brew of which is good for renal stones, rheumatic fever, gout, etc. The brew is prepared from 20 grammes of red bilberry leaves to

a glass of water; a table-spoonful of honey may be added to a glass of the brew.

Saxifrage (Pimpinella saxifraga L.). A table-spoonful of saxifrage brew in water or wine (one to one) or an infusion (10 roots to 200 grammes of water) with honey should be taken three to five times a day. Both the brew and the infusion are considered very effective expectorants and act as a tonic for convalescents.

Saxifrage tea with sweet-brier and honey is prescribed for bladder stones (two glasses a day). A. Raff considers this tea very effective. In an almanac which saw its 24th edition in 1945, I. Künzle, a well-known Swiss herbalist, recommends a table-spoonful of saxifrage powder with honey every four hours for diphtheria patients.

Sweet violet (Viola odorata L.). Violet is prescribed for coughs and as an expectorant. A. Oertel and E. Bauer advise violet-leaf tea with honey for consumption and bronchial asthma. Other authors also consider it a good remedy for pulmonary tuberculosis. Three table-spoonfuls of the tea should be taken every three hours, especially if the cough is violent.

Thyme (Thymus vulgaris L.). S. Zemlinsky says that drugs prepared from thyme flowers and leaves are good for whooping cough and colds.

Galen and Avicenna attributed to thyme important therapeutic properties in gastric and intestinal diseases. A. Oertel and E. Bauer state that thyme tea with honey is a specific drug for tapeworms. In this case, tea prepared from 20 grammes of thyme and 250 grammes of water and honey should be drunk for four to six weeks.

Valerian (Valeriana officinalis L.). Tincture of valerian enjoys wide popularity as a sedative for nervous excitement, insomnia, etc.

Sebastian Kneipp recommends tea of valerian root and rue with honey for hysteria (a table-spoonful every two hours).

Woadwaxen (Genista tinctoria). Until recently, popular medicine used woadwaxen as remedy for scrofula, fractures, venereal and skin (herpes, boils) diseases. Woadwaxen seeds contain cytisine ($C_{11}H_{14}N_2O$), an alkaloid stimulating respiration.

According to S. Zemlinsky tea of green leaves and stalks of woadwaxen was recently tried in a clinic and found to yield a good therapeutic effect in treating diseases of the thyroid gland. Oertel and Bauer say that woadwaxen tea with honey containing about 20 per cent of tanning substances is very effective in collapse, cardiac insufficiency and hypotension.

Chapter III

NEW KINDS OF HONEY

THE EXPRESS (ACCELERATED) METHOD OF PRODUCING HONEY

Ivan Michurin said: "We are living at a time when man's sacred duty is not merely to explain but to remake the world, to make it better ... now we are able to interfere in nature's work."

The problem that interested us was whether bees could be made to produce different kinds of honey.

Since bees extract poisonous nectars from plants and process them in their honey-stomachs without suffering any harm, we wondered if they could be compelled to extract juices from medicinal plants or convert into honey artificial medicinal solutions, fruit and vegetable juices, and the like.

So at an apiary in the Far-Eastern taiga we started our experiments with several bee colonies. Feeders with syrups containing various food-stuffs (milk, eggs, fruit and vegetable juices, etc.) and drugs (phytin, calcium chloride, streptocide, vitamins, etc.) were introduced into the hives. Four colonies received syrups containing various medicinal dyes such as brilliant green, methylene blue and eosine, while three colonies were given endocrine preparations in syrup (thyreoidine, hepatocrine, ovarine).

The artificial solutions were prepared in enamelled vessels and poured into the feeders from an enamelled tea-

kettle very carefully and quickly, so that bees from other hives who were collecting nectar from blossoming plants would not be attracted. The wooden feeders were filled every day with a quantity of syrup that in ordinary conditions would have necessitated 15,000,000 visits to the flowers of, say, red clover. The bees evaporated the moisture from the syrups and in processing enriched them with organic acids, enzymes, antibiotics, and so forth. The experiments lasted several months, but a few days after they were started we observed the bees leaving beespaces and coming to the feeder every time we opened the cover to put in the syrup. Right from the very beginning, scout-bees had tasted the syrup, informed their sisters of their rich find and drawn them to it.

Soon the bees grew accustomed to the new conditions when they did not have to leave the hive in search of nectar and encounter birds, wasps and other enemies.

Each time we removed the cover we filled the feeder with syrup; *removing the cover* was therefore associated with *feeding*. To use Ivan Pavlov's terminology, the feeder with syrup was an unconditioned stimulant, while the sound of the cover being removed, the light that came into the hive and the smell of the syrup were conditioned stimulants or signals. From Pavlov's experiments we know that if a blue lamp is lighted each time a dog is given its food, the lighting of the lamp will after a time cause the dog to secrete saliva. Pavlov pointed out that "*the first and most important requirement for the formation of a conditioned reflex is coincidence in time of the action of the hitherto indifferent agent with that of the unconditioned agent which causes an unconditioned reflex*" (Pavlov's italics).* Like other scientists, we came to the conclusion that Pavlov's teaching of conditioned reflexes can be applied to bees. Indeed, in our experiments the normal life of the bee colony was disturbed,

* I. P. Pavlov, *Selected Works*, p. 175.

because instead of natural nectar the bees were given a wide feeder with artificial nectar. As we have already said, the first to come to the feeder were scout-bees, which were followed by hundreds and thousands of other bees. The repeated removal of the cover and filling of the feeder with syrup formed a conditioned reflex in the bees.

In another experiment, when we removed the cover, the bees rushed to the feeder, expecting to find nectar in it; so many bees collected in the feeder that they had to struggle for room on the "rafts."* But we did not pour the syrup into the feeder. The bees circled around us, buzzed, while some, less patient than the others, went down the bee-spaces to ripen green honey in the combs. As time went by, the number of bees on the feeder grew less. At last there was not a single bee left. Then we put the cover on. When we repeated the experiment a few hours later we observed that the bees behaved in the same way. Thus, this experiment, too, proves that a conditioned reflex can be created in bees.

Basing ourselves on this premise, we elaborated the following express method of producing different kinds of honey.

When a worker-bee is given a piece of sugar she wets it with a drop of enzymatic fluid (containing invertase), which flows down her proboscis, and then sucks up the solution. Through the oesophagus the sugar solution (or nectar) goes to the honey-stomach, the reservoir for storing nectar, regardless of whether it is natural or artificial. The capacity of this "reservoir" is from 14 to 18 ml. The honey-stomach consists of a thin chitinous membrane and two layers of muscles. The contractions of the muscles force the honey from the honey-stomach either back to the proboscis and then into a cell, or into the true stomach (ventriculus). The upper end of the true stomach

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* The "rafts" were thin laths covered with wax, which were put in the feeder to prevent bees from drowning in the syrup.

(proventriculus) protrudes into the lower end of the honey-stomach in the form of a small cone with an X-shaped opening. This opening is called the stomach-mouth. Its four lips are very active, as it consists of numerous striat-

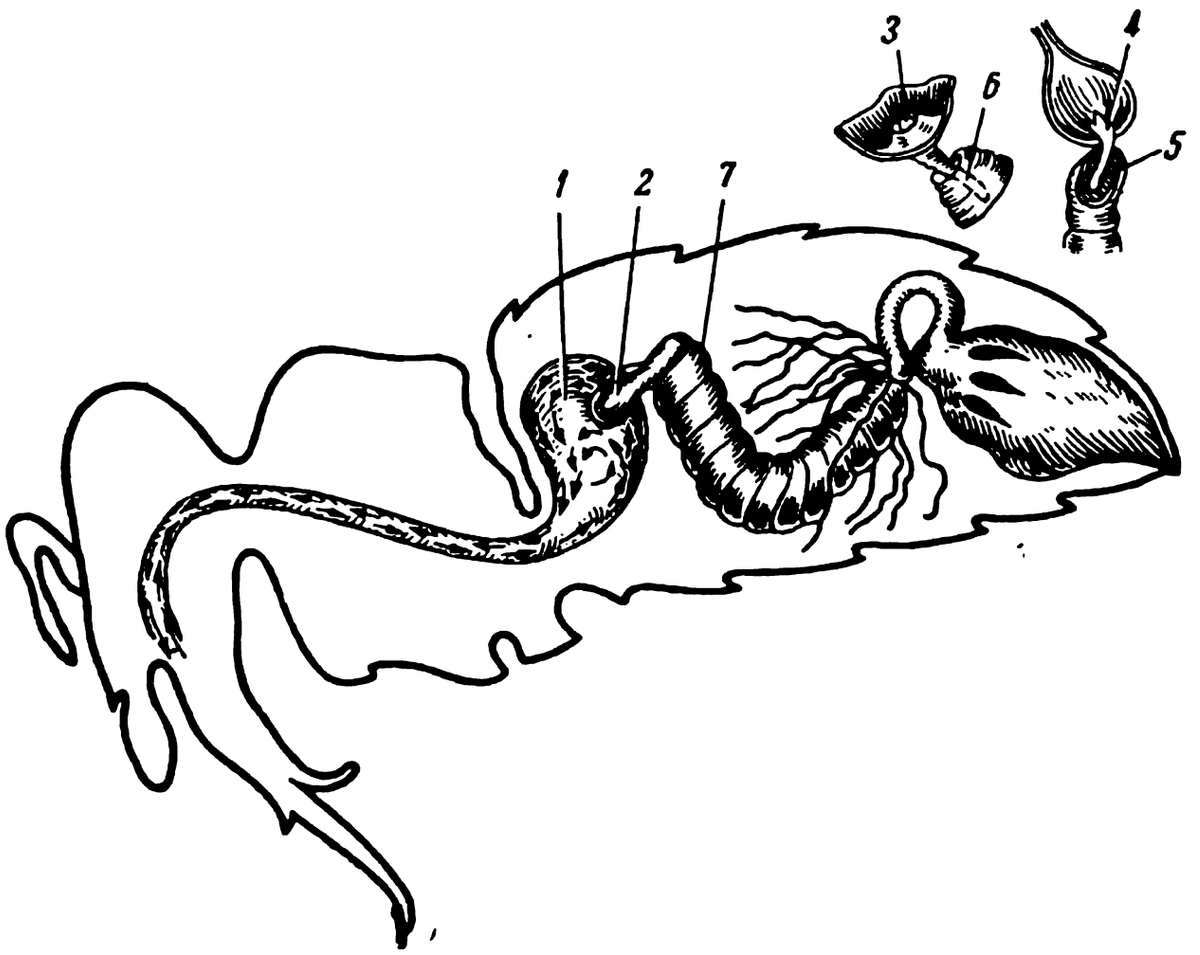

Fig. 8. Diagram of honey processing in the body of a worker-bee: 1. Honey-stomach; 2. Proventriculus; 3. Stomach-mouth (its four thick lips are closed); 4. The thick lips of the X-shaped stomach-mouth are open; 5. Part of the ventriculus is cut open to show the posterior end of the proventriculus extending in a funnel-like fold into the ventriculus; 7. Ventriculus, or true stomach.

ed and nonstriated muscles (Fig. 8). Its physiological function is to take whatever food the true stomach requires from the honey-stomach. Nothing, however, can return from the true stomach into the honey-stomach, because the valve is tightly shut and backward movements block the opening.

In spite of its minute size, the worker-bee's honey-stomach is a live laboratory in addition to serving as a

reservoir. Experiments show that if bees are given a 50 per cent solution of straight sugar, half an hour later 42 to 44 per cent of it will be processed into glucose and fructose. This is because important enzymatic processes, primarily the inversion of sugars, take place in the honey-stomach.

This phenomenon is the foundation of our express method.

When we filled the feeder with artificial nectar, which certainly differs from floral nectar, bees gathered on the feeder and worked actively, transporting processed sweet medicinal and other solutions to the combs. Nature's own pharmaceutists, bees processed artificial nectars into the corresponding kinds of honey. We removed the frames containing this honey, put empty combs in their place, washed the feeder with warm water, dried and filled it with a fresh portion of syrup and put it back into the hive. The hives were thus converted into factories where bees worked day and night to produce honeys of various chemical and biological compositions.

In this way we obtained 85 kinds of honey—medicinal, multivitamin and others. The method proved highly economical, especially in spring and autumn when few honey plants are in bloom and when bees usually consume their stores of honey.

The express method is also economical in that from a kilogramme of sugar bees make a kilogramme of honey. As S. Rozov, A. Gubin and P. Komarov say in their *Beekeeping*, "If bees are fed 1.5 kilogrammes of syrup consisting of a kilogramme of sugar and half a kilogramme of water, you will find in the hive a kilogramme of sealed honey made from the sugar by the bees, the honey consisting of 0.75 kilogramme of sugar and 0.25 kilogramme of water. Bees, therefore, should be fed as much sugar as you want them to produce honey, disregarding the percentage of water."

Michurin biology and Pavlov physiology prove that feed-

ing is a kind of mentor. The quality of the food is the factor that influences the formation and growth of the bee. The influence of artificial nectars on the colony is undoubtedly very great.

We have been able to establish that artificial nectar containing proteins, vitamins and mineral salts favourably influences the worker-bees, increasing their vital capacity and resistance to adverse influences and infections. The fourteen series of experiments we made at apiaries of the Far East, the Ukraine, Central Asia, the Urals, Moscow Region and other places showed that the worker-bees which were given artificial nectar so as to produce honey in autumn, usually wintered well and contracted no diseases.

We have tried the express method under different climatic conditions—in Abkhazia, where bees stay in the open for nearly nine months of the year, and within the Arctic Circle, where they are stored away for the greater part of the year. The method can be employed with any strain of bees and in any type of hive.

NEW HONEYS OBTAINED BY "EXPRESS" METHOD

Multivitamin honey. To obtain honey containing different vitamins, we prepared syrups from sweet-brier berries which are rich in vitamins C, B, E, A (carotene), from the juices of various vegetables and fruits, and sometimes from synthetic vitamin preparations. From the artificial multivitamin syrups bees produced honey which contained not only the given set of vitamins, but also glucose, enzymes, organic acids and other substances.

The production of honey which contains several vitamins is very important, because with its high concentration of valuable sugars (glucose, levulose) this honey excellently preserves the activity of vitamins, primarily of vitamin C. Twenty-three samples of multivitamin and vitamin honey,

produced by the express method, were tested in the laboratory and found to contain highly active vitamins.

Some of the samples were analyzed chemically, and found to contain the following amounts (in milligrammes) of vitamin C (ascorbic acid) per kilogramme:

Honey No. 1 (vitamin)	188
Honey No. 2 (vitamin)	217
Honey No. 11 (phytin-lily-of-the-valley and vitamin)	322
Honey No. 17 (mammin-vitamin)	51.2
Honey No. 24 (osarsol-vitamin)	97.8
Honey No. 31 (atophan-vitamin)	61.6
Honey No. 38 (iron*-cocoa-milk-egg and vitamin)	142.4
Honey No. 39 (coffee-milk and vitamin)	94.4
Honey No. 41 (cream and vitamin)	52
Honey No. 43 (egg-yolk and vitamin)	237
Honey No. 67 (protein and multivitamin)	760

Samples of linden and buckwheat honeys obtained at the same apiaries at the same time in the natural way contained *no traces of vitamin C.*

When some of the above honeys were tested for vitamins B_1 and A (carotene), they were found to contain considerable quantities of these vitamins as well.

These examples show that the express method enables us to interfere in the life of the bee colony and make bees produce honey with the necessary vitamin content.

Haematogen honey. To create a honey containing blood means getting a new food of a very complex and valuable chemical and biological composition. To carry out this task, we kept animals at our apiary. These animals became the donors of the blood which we added to the syrups in the feeders.

A 4 per cent solution of sodium citrate was added to prevent blood from clotting. The bees quickly emptied the feeders of their sweet content and produced honey from it.

In some experiments we used the blood of slaughtered

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* A solution of proteinic iron.

cattle, to which we also added sodium citrate and sugar syrup.

We wanted to see what effect a solution of haematogen honey injected intravenously would have on animals. We thought that this honey must prove more effective than glucose, or that it could even be used instead of blood in transfusions. The experiments on dogs were carried out at the Ukrainian Institute of Experimental Biology and Pathology (now named after Academician A. Bogomolets) under the guidance of D. Brusilovskaya in 1940.

After the dogs were weighed, and their blood was investigated for the content of haemoglobin; erythrocytes, leucocytes and for the sedimentation rate, They were exsanguinated and a solution of haematogen honey filtered through a Seitz filter was injected intravenously to them. One of the carotids was connected with the kymograph which traced a graph of the blood pressure on a blackened paper strip moving between two reels. When the blood pressure abruptly fell the graph presented a thin straight line instead of a dentate curve. At such moments, we quickly removed the clamp from the rubber pipe connecting the dog's femoral vein with the vessel filled with the haematogen honey solution. The solution then entered the blood by way of the femoral vein and the dog showed symptoms of revival, which was demonstrated by the dentate line of the kymograph curve. The experiment ended with this and the wounds in the dog's neck and thigh where the vessels had been exposed were sutured. The dog's condition was satisfactory as was the case with the second dog experimented on. It should be noted that the amount of the haematogen honey solution the dogs received was less than that of the blood drawn.

A solution of glucose in a quantity equal to that of the blood loss was injected into the femoral veins of two other dogs of identical sex and weight under similar conditions. The state of all the dogs was satisfactory, but blood investigations showed that a haematogen honey solution made

the blood regenerate better than a glucose solution. The reason for this is that haematogen honey contains a number of substances of a complex composition and structure necessary for the life of cells and tissues and favourably influencing the whole organism.

These experiments with intravenous injections of haematogen honey show that this honey produces a positive result. But whenever we tried, together with veterinary surgeons, to inject intravenously heat-sterilized but not filtered honey to horses, the animals always underwent shock (sharp decrease of blood pressure, chills, etc.). We think this is due to the fact that even after boiling, honey solution always contains minute particles of wax, vegetable proteins and so forth. Therefore, for experiments such as these the honey must be passed through a special filter (of the Seitz type), which detains bacteria and other microscopic particles.

Some psychiatrists have practised honey therapy in the form of intravenous injections of 40 to 60 per cent solutions of honey, and in all cases observed the development of shock. We are inclined to explain the violent shocks observed after the injection of honey to schizophrenic patients by the action of vegetable proteins, wax particles and other harmful substances. The picture is entirely different in the case of express honey produced by bees from artificially prepared nectar.

We think that the above experiments on animals should be continued with the purpose of finding more effective and safe methods of injecting haematogen honey intravenously.

Carrot honey. We were given five bee colonies for our experiments at an apiary of the Ukrainian Research Station of Apiculture. The apiary was situated in a picturesque locality near Bucha, a railway station in Kiev Region. The blue and yellow hives stood in neat rows in a large orchard with trees, weighed down by fruit. Here we engaged in our

fourth series of experiments, which were aimed at obtaining carrot honey.

Carrot (*Daucus carota L.*) is a famous popular remedy. Ancient Russian manuscript medical books state that "carrots urge urine and are good for people suffering from melancholy" and that "the roots ... regenerate blood."

In 1938, Dr. M. Aronov successfully healed wounds with carrot juice, thereby proving its high bactericidal properties. The red carrot is rich in sugar and the salts of calcium, iron, phosphorus, as well as vitamins. It is a concentrate of almost all the vitamins known today including carotene (precursor of vitamin A), aneurin (B_1), riboflavin (B_2), ascorbic acid (C).

Soviet investigators point out that riboflavin increases the resistance of the body to infections.

Carrots contain pantothenic acid, which is essential both for humans and animals as it takes part in carbo-hydrate metabolism.

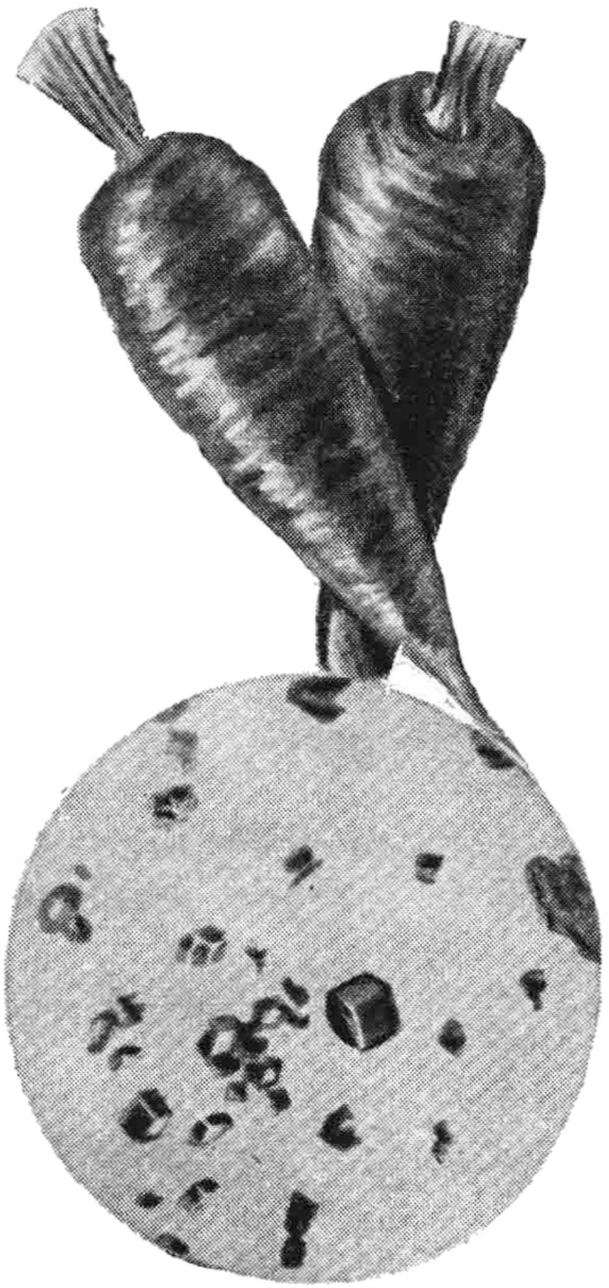

Fig. 9. Crystals of carotene obtained from carrot

Carrots also contain nicotinic acid (vitamin PP), hesperidin and citrin (vitamin P), precursor of vitamin D, the antihaemorrhagic vitamin (vitamin K), a large percent-

age of biotin (vitamin H) and other vitamins not yet sufficiently studied. Carrots are 18 times as rich in precursor of vitamin A as blood and twice as rich in vitamin D as hog liver.

Raw carrot juice is very popular.

From time immemorial, the vegetable kingdom has been the chief source of drugs and medicines, and the red carrot, especially its juice, has to this day retained its importance as a remedy of popular medicine. Carrot juice is prescribed as a diuretic, in cases of renal stones, anaemia and other diseases.

In our experiments we wanted the bees to process the juice of the red carrot (the red carrot contains 87 per cent juice) into honey. Juice was pressed from carrots, sugar was added and the syrup was given to the bees.

The bees took it eagerly and in processing it into honey removed the extra moisture and added enzymes, organic acids, inhibitors, etc. When the honey was sealed, we extracted it from the combs.

Milk honey. Back in 1880, N. Lunin, a Russian physician, arrived at the interesting and daring conclusion that in addition to the then known components such as proteins, fats, carbo-hydrates, and mineral salts which are necessary for the normal functioning of a living organism, milk contained minute doses of some unknown but equally important substances. Later these substances were called vitamins.

From ancient times, almost all nations held that milk with the addition of honey was good for the lungs, for anaemia and emaciation. Milk and dairy produce, or milk and honey, are today the only food allowed both adults and children in some diseases.

But milk spoils easily and cannot be kept long and although boiled milk keeps longer, boiling destroys the enzymes and other valuable components of milk. Another drawback of milk is that it contains too much water (87 to 88 per cent water and 5-6 per cent sugars), while honey

contains only 20 per cent moisture and 70 to 75 per cent sugars. So we decided to combine the high nutritive properties of the two foods and utilize for this purpose the ability of bees to remove moisture from the "nectar" and to preserve rapidly decomposing organic substances, at the same time assuring their assimilation.

At the Kiev apiary of the Ukrainian Research Station of Apiculture we gave bees solutions containing milk and obtained milk honey.

The method of obtaining milk honey is simple and practicable. Sugar is dissolved in fresh milk from a healthy cow and when the solution is saturated, it is given to bees. The bees take it willingly and on the next day the honey can be extracted and put into glass jars. Milk honey is whitish-yellow, has a pleasant aroma and tastes like sugar candy.

The chemico-bacteriological analysis of milk honey made at the Kiev Research Institute of Dietetics yielded the following data: the specific gravity of the honey was 1.1125 (at 15°C.), moisture content—20.8 per cent, solid substances—79.2 per cent, nitrogenic substances (casein, albumin, globulin)—1.622 per cent, fat—1.33 per cent, sugars—74.7 per cent, glucose and lactose—37.2 per cent, levulose—25 per cent, and mineral salts—1.4 per cent. In culturing honey in the laboratory in such media as gall and the Bulir medium, the Bact. coli and Bact. typhi abdominalis and paratyphi were not discovered.

The chemico-biological composition of milk honey has not yet been fully elucidated, but we think that this honey is beneficial to the human body, especially in the period of growth. Milk honey may be taken as a drink (two spoons of honey diluted in a glass of tepid water); it keeps long and does not spoil even in an uncovered vessel. Milk honey is an excellent preserver of vitamins, of vitamin C in particular.

Ginseng honey. A maxim of Chinese medicine, one of

the most ancient in the world, is that it is better to prevent disease than to treat a sick man.

The Chinese hold the ginseng root in high esteem, calling it "a wonder of the world, the gift of immortality."

Ginseng belongs to the Araliaceae family and its root resembles that of parsley. Its properties, however, are un-

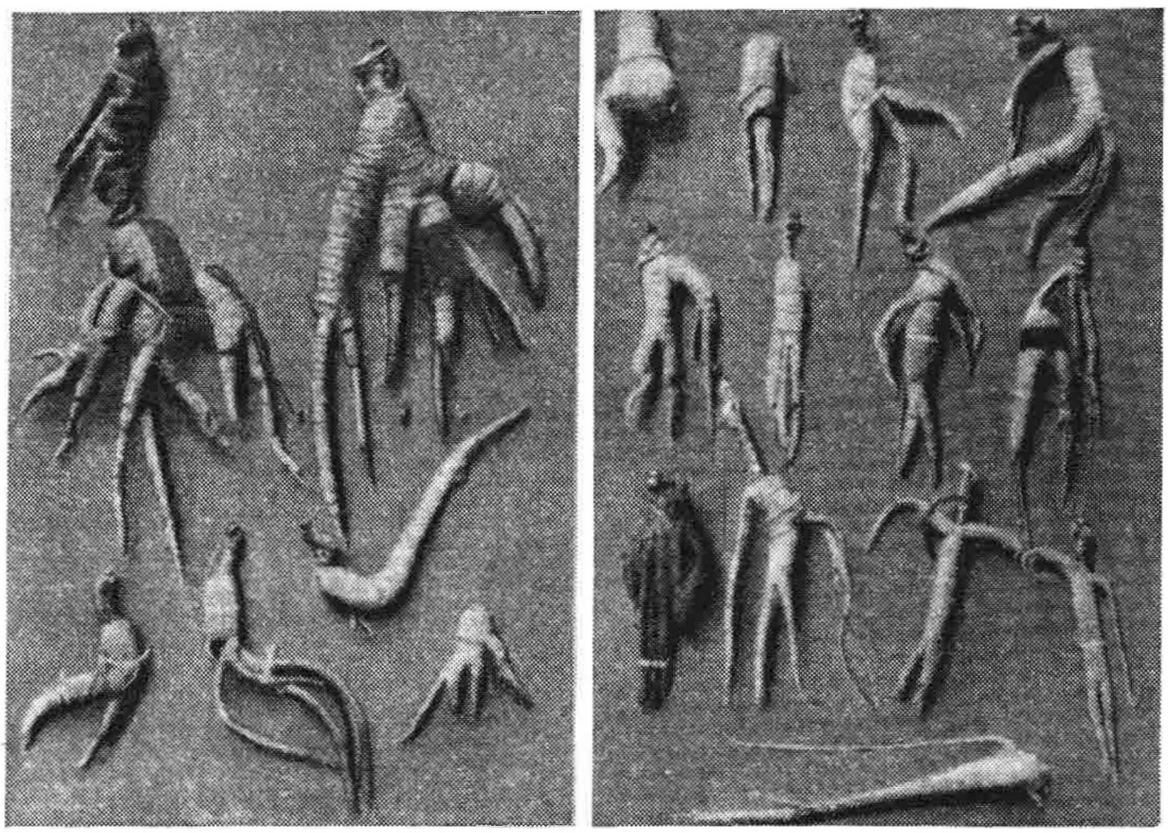

Fig. 10. Collection of ginseng roots

like those of any other plant. Its very name is associated with legend—*ginseng* meaning "man-root" or "the root of life." The Chinese regard the tiger as the king of beasts and ginseng the king of plants.

For thousands of years the Chinese and other Asian peoples have used and continue to use ginseng as a very potent drug.

Ivan Michurin was very interested in the therapeutic properties of ginseng, and went so far as to plant six ginseng roots in his garden. Many observations in his posthumously published works deal with this fabulous

plant. In a chapter entitled "Therapeutic Properties of Ginseng," Michurin wrote: "Every good housewife in China has a ginseng root in her house. Everybody wants to have some, even so little as an ounce, of this valuable and important root. Ginseng brew is a favourite beverage in China. Almost everybody drinks it. The beverage is prepared simply by boiling chopped pieces of the root in water. It combats every disease and even serves to prevent illness. Some rich people add this wonder-working root to their food for its aroma and flavour, but only the rich can afford to do this regularly. Ginseng root lends a very pleasant flavour to meat. In China every family man has this ancient drug in his home."*

Michurin also quotes the report of Dr. F. P. Smith who gave a detailed description of the medicinal properties of ginseng. "This drug is from a brew in a silver vessel and its curative potency undoubtedly manifests itself as a tonic, a stimulant and a calmant. It is said to be very beneficial and safe against almost every disease. In all kinds of ailments, in spermatorrhoea, haemorrhoids, persistent nausea during pregnancy, in fevers, especially in infectious diseases, the Chinese use the inferior sorts of ginseng root, which they take in minute doses, and yet when used judiciously ginseng produces a curative effect."**

Ginseng takes between 100 and 300 years, sometimes longer, to grow and occurs in ravines on soil that some scholars believe are radioactive; that is a factor which undoubtedly plays an important role in the curative properties of this root. Ginseng gatherers say that it usually grows where neither beast nor bird nor even the sun can penetrate. Investigations of the chemical and medicinal properties of ginseng made in this country, particularly in the Soviet times, show that its therapeutic activity is

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* I. Michurin, *Works*, Selkhozgiz, Moscow, 1941, Vol. IV, p. 176.
** *Ibid.*

manifold and varied. A special committee has been set up to study its properties.

We decided to obtain ginseng honey by the "express" method, as we supposed that it would be more beneficial to the human organism than either the plant or natural honey separately. Moreover, ginseng tincture has an unpleasantly bitter taste which disappears when honey is added. In China and Tibet ginseng with honey is recommended for nervous diseases.

An interesting fact revealed in the experiments was that in the colony producing ginseng honey, the queen began to lay eggs more vigorously, influenced, no doubt, by the food containing ginseng. Her unusually intense performance interfered with our plans, because the empty cells became filled with brood instead of honey and the worker-bees were engaged in constructing new combs when we wanted them to prepare honey from the syrup. So we removed the queen from the experimental colony and the worker-bees for several days were so busy working the ginseng honey that they did not notice they were queenless. Usually the absence of the queen is noticed immediately and the bees rush to and fro in search of her. This observation leads us to suppose that ginseng contains some hormone-like substances.

The peculiarity of the ginseng honey which we obtained by the "express" method was that it granulated in the comb immediately after it was sealed. Another feature of this honey is that, unlike all other honeys, it is not sticky and can be kept in paper containers.

Ginseng honey has a pleasant flavour and delicate aroma; a piece of comb containing it can be easily broken off and chewed. The honey is not hard to obtain, and at the same time it is a very important remedy for some diseases.

Beetroot and brier honey. In our series of experiments, a bee colony was given artificial nectar containing the juice of beetroot, brier infusion and cherry leaves brew.

Instead of sugar, we used cheap by-products of the food industry (molasses, used-up glucose, etc.). Bees, those industrious little pharmaceutists, were given raw materials from which they had to produce a new type of honey. The honey (listed as No. 82) has the delicious aroma and flavour of cherries and is cherry-coloured. Many persons who have tasted it thought it was made from cherry juice.

Pine honey. Pine needles are known to possess remarkable properties as they are a concentrate of vitamins. Pine needles contain ten times as much vitamin C as potatoes, and four times as much as lemons. Besides, they contain considerable amounts of vitamins A and K. Pine honey is easy to obtain, because pine- and fir-trees grow everywhere in great numbers and there is no difficulty in preparing pine syrups of high vitamin concentration.

The honey produced from the sweet syrup brewed on pine needles was greenish amber, had a delicate flavour and slightly resinous smell. The colony that was fed pine syrup increased its brood almost four times over as compared with the control colony which received an identical syrup but without pine needles.

PRODUCING HONEY IN WINTER

It is common knowledge that bees work only in the spring and summer while in the autumn and winter they rest and eat the honey made during the honey-flow.

We wanted to see if bees would take and process artificial nectar in the winter—in a greenhouse. In our experiments, we were assisted by apiarists B. Krasnyuk and A. Klimenko.

The experiments showed that at 21°C. the bees flew about and every day cleared the feeder (we gave them pine syrup) and processed the syrup into honey.

We were able thus to prove that the "express" method of obtaining honey can be applied in any season.

PROSPECTS BEFORE THE "EXPRESS" METHOD

In our experiments, bees produced honey from foods and also from drugs with an unpleasant taste and odour (quinine, moulds, etc.). Bees can be easily accustomed to the taste and odour of any drug by adding at first minute amounts to the syrup and gradually increasing the doses. The winged "laboratory workers" learned quickly not to mind the—to us—unpleasant syrups and settled down to prepare honey from them.

Our experiments were made in the Far East, the Ukraine, Central Asia, the Urals, Moscow Region and in other parts of the Soviet Union and convinced us that the "express" method of obtaining honey can be applied regardless of the climate, season, type of hive and strain of bees.

We used various materials (vegetable, herb, fruit and berry juices, vitamins, endocrinic preparations, drugs, dyes, moulds, etc.) in our experiments to obtain highly nutritive, medicinal and multivitamin honeys.

The "express" method holds great promise for the future, as it enables the beekeeper fully to control the life and activity of his bees, thereby converting the apiary into a living factory where honey of any given composition can be produced. The food industry can utilize the "express" method in order to obtain highly nutritive multivitamin honeys.

A FEW TIPS ON THE "EXPRESS" METHOD

From the foregoing, it is clear that the "express" method of obtaining honey is based on the ability of bees to make honey from artificial sweet syrups made to a given recipe. Observations conducted over many years have shown the method to be very economical, because the bees receiving artificial nectar in the hive require less food to compensate for the energy expended in flights to blossoming

honey plants. It has been proved in the course of the experiments that artificial nectar prepared from perishable food-stuffs—milk, eggs, blood—and processed in the bee's honey-stomach into honey becomes non-perishable, that saccharose is converted into glucose and levulose and the whole is enriched by enzymes, organic acids, inhibitors, etc. Honey obtained by the "express" method not merely differs from the artificial nectar in its physical and chemical composition but is assimilated much easier than the mother products.

Honey has long been known to increase the haemoglobin content of blood and to help people put on weight and enhance their physical strength. Furthermore, it is a favourite sweet with children. In this connection, it is important to stress that the "express" method enables us to obtain honeys from multivitamin, medicinal, endocrinic and other preparations. By way of illustration, here are some of the components of artificial nectars: atophan, potassium bromide, sodium bromide, adonilen, alcohol (in different concentrations), veronal, vitamins (A, B, C, D, PP, E and others), gitalene, digitalis, proteinic iron, ginseng, sodium iodide, calcium chloride, potassium iodide, caffeine, lily-of-the-valley, osarsol, pepsin, sodium salicylate, saccharine, sekalen, hydrochloric acid, streptocide, sulphidine, urotropin, phytin, phosphren, quinine, hepatocrine, mammin, ovarine, pancreacrine, pantocrine, parathyreocrine, spermocrine, brilliant green, methylene blue, fuchsin; the juices of water-melon, cabbage, carrot, tomato, radish, onion, pumpkin, beetroot, and other vegetables, of pear, strawberry, blackberry, apples, of the leaves and stalks of walnut, strawberry, clover, nettle and maize; cocoa, coffee, the blood of domestic animals and poultry, milk, eggs, various moulds, etc.

The processing of artificial nectars into honey in autumn not only yields a desirable kind of honey but saves tons of natural honey which is usually consumed by bees.

We have seen in the course of our experiments that cer-

tain honeys have a good effect on the bee colony. Some substances in artificial nectars stimulate the queen to lay more eggs even in late autumn, others goad the bees on to construct combs.

It goes without saying that when the "express" method is applied, all hygienic requirements should be strictly observed; the beekeeper must wear a clean smock and wash his hands thoroughly with soap before preparing an artificial nectar.

The best artificial nectar is one that contains fifty per cent sugar. The syrup should be poured into clean wooden feeders at fixed hours (morning and evening), which facilitates its processing by the bees. The syrup should be warm (room temperature) and should be poured quickly and carefully so as not to attract bees from the neighbouring hives. The feeders must be in good condition, for otherwise the syrup will leak out, soil the bottom board and the bees will be drowned in it. To prevent the bees from drowning in the feeders, thin wax-covered laths—"rafts" —should float in the syrup. The honey should be extracted not earlier than three days after the artificial nectar is put in the feeder (or, better still, after the bees have sealed the new honey), because experience shows that before that time honey contains 10 per cent saccharose (this is because the bees have not had time enough to convert all the sugar into glucose and levulose.) The honey extractor and the vessels in which honey is to be kept must likewise be clean.

"Express" honey should be stored in a dry and dark place where there are no foods such as herring, sauerkraut, etc., or substances like petroleum, tar, benzine, all of which have a strong odour. Beekeepers producing "express" honeys should not feed bees on artificial nectars containing drugs without medical supervision. The name of a honey must be in keeping with the chief constituent of the nectar: if the nectar is made up chiefly of carrot juice, the honey should be called *carrot,* etc. All samples,

whether in jars, glasses, kegs, or other holders, must bear labels stating the date of production, the name and location of the apiary. To sell "express" vitamin honeys to trading organizations, it is necessary to obtain the approval of the State Sanitary Inspector and a laboratory certificate showing the qualitative and quantitative analysis for vitamins.

MULTIVITAMIN HONEY

In the U.S.S.R. medicine develops through the elaboration of new methods of preventing and treating diseases. In this light, large-scale production of multivitamin honey by the food industry for the needs of practical medicine and also for prophylactic use by the population is of vast importance. Multivitamin honey is natural bee honey enriched with essential vitamins and calcium salts.

The vitamin industry in the U.S.S.R. produces a wide range of very active vitamin preparations. It is common knowledge today that negligible amounts of vitamins not merely protect man from various diseases—avitaminoses —but also increase the defensive power of the human body against infections and adverse influences of the external environment.

Drs. R. Nikolayev, K. Povolotskaya and N. Vodolazskaya have proved with experiments on guinea-pigs that concentrates of vitamin C extracted from sweet-brier berries and other plants are more effective drugs than synthetic ascorbic acid. This is because ascorbic acid derived from plants contains, in addition, other biologically active substances, such as flavones, catechols and related compounds.

Clinical observations show that synthetic vitamins are better assimilated if taken in combination with natural food. Multivitamin honey, therefore, is an exceptionally valuable product in this respect. It contains vitamins A (axerophthol), B_1 (aneurin), B_2 (riboflavin), C (ascorbic acid), PP (nicotinic acid) and D (calciferol).

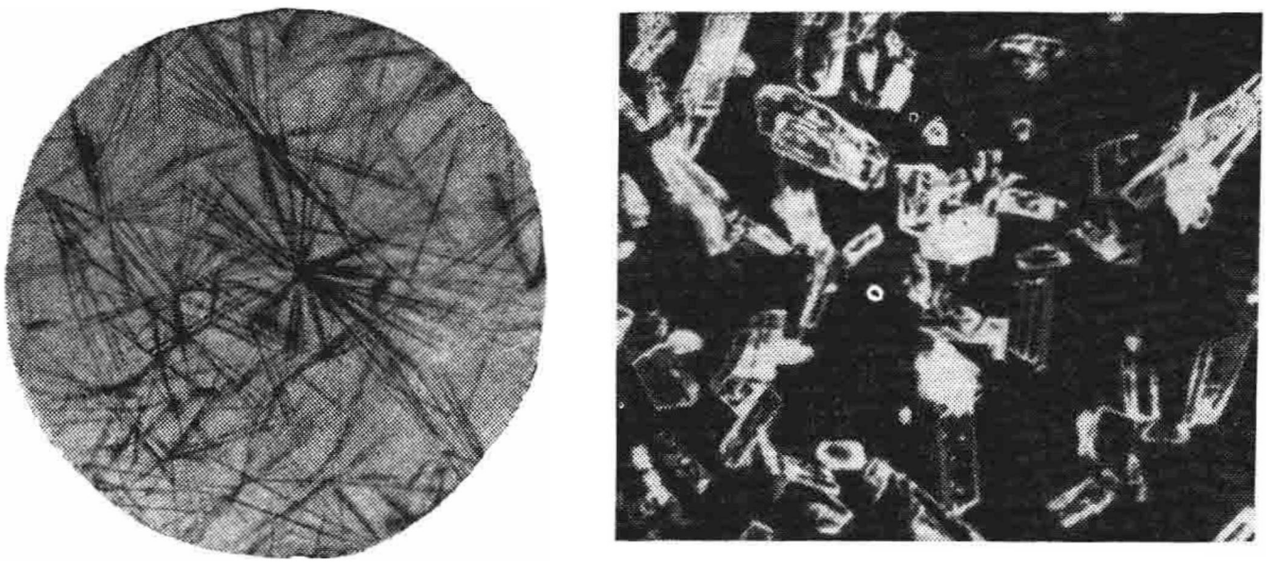

Fig. 11. a. Crystals of precursor of vitamin A; b. Crystals of vitamin B

This complex of vitamins is tremendously important for the human body.

Here is a brief description of the physiological properties of these vitamins.

Vitamin A increases the defensive power of the skin and mucous membranes, is essential for normal vision and the activity of the endocrine glands. It is considered to be an anti-infection factor. Furthermore, it stimulates the process of growth.

Vitamin B_1 takes an active part in the metabolism of carbo-hydrates, proteins and fats and very favourably influences the nervous system. Some scholars justly call it "nature's bromide."

Vitamin D prevents the development of rickets and promotes the development of teeth and bones.

Vitamin PP takes an active part in protein metabolism.

The importance of calcium for the body lies not only in it being the chief constituent of the bones but also in its ability to activate the defensive power of the body in the fight against infection (stimulating phagocytosis).*

Calcium also facilitates complete assimilation of food, favourably influences blood clotting and acts beneficially on the nervous and cardiovascular systems.

* Phagocytosis is the act of destroying various substances absorbed by the animal cells. Ilya Mechnikov established that leucocytes can envelop and digest pathogenic microbes that invade the organism.

One hundred grammes of multivitamin honey No. 1 contain 13,200 I.U.* of vitamin A, 8 milligrammes of vitamin B_1, 8 milligrammes of vitamin B_2, 300 milligrammes of vitamin C, 60 milligrammes of vitamin PP and 3,200 milligrammes of calcium salts. The daily dose of multivitamin honey No. 1 for a healthy person (adult) is 25 grammes; the dose may be increased on the doctor's advice.

One hundred grammes of multivitamin honey No. 11 (for children) contain 13,200 I.U. of vitamin A, 6 milligrammes of vitamin B_1, 8 milligrammes of vitamin B_2, 300 milligrammes of vitamin C, 60 milligrammes of vitamin PP, 4,000 I.U. of vitamin D and 4,000 milligrammes of calcium salts. The daily dose of this honey for a healthy child is 25 grammes.

To obtain larger amounts of multivitamin honey, an electric mixer is installed in the bottling and corking departments. The mixer distributes with great precision the vitamins and calcium salts in equal doses between the crystals of invert sugars and other honey constituents. The enrichment of honey with vitamins is secured by the fact that the water-soluble vitamins C, B_1, B_2, and PP are quickly dissolved in the highly hygroscopic (containing about 20 per cent water) honey and are distributed between the crystals of glucose; the fat-soluble vitamins A and D become "pulverized" into minutest globules and dispersed among the crystals of glucose and levulose. Experiments show that the viscosity of honey prevents the minute globules of fat-soluble vitamins from combining into one. Chemical analysis or microscopic investigations can prove that multivitamin honey is a homogenous mass with uniformly distributed particles of honey, vitamins and calcium. This is proved also by the uniform light-yellow colour that honey gets from riboflavin (vitamin B_2). As honey is exceedingly well absorbed by the mucous membrane of the gastro-intestinal tract it is an excellent vehicle for vitamins and calcium, which, together with honey, penetrate easily into the blood stream.

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* I.U.—international unit. One milligramme of vitamin A is equal to 3,300 I.U., and one milligramme of carotene (precursor of vitamin A) is equal to 1,660 I.U.

Multivitamin honey costs a little more than natural honey, but it is much cheaper than its components—honey, vitamins and calcium—taken separately. Adults and children can take multivitamin honey in combination with various foods.

Multivitamin honey will probably prove effective in treating radiation sickness and, particularly, in preventing the harmful effect of ionizing radiations.

Now that the radioactive isotopes are widely used in medicine, the problem of controlling radiation sickness has acquired extreme importance. Soviet scientists prescribe vitamin B_6 (pyridoxin) and intravenous injections of glucose with vitamin C for this condition.

Our observations have shown that vitamin honey produces in some cases an effect similar to that of glucose and vitamin C injections. An advantage of vitamin honey is that it can be taken as a preventive measure.

PRESERVATION OF VITAMINS IN VITAMIN HONEY

It is a well-known fact that long storage deprives all food-stuffs of active vitamins. In this connection we decided to find out for how long vitamins are preserved in vitamin honey.

We enriched honey with ascorbic acid (vitamin C) at the chemico-analytical laboratory of the U.S.S.R. Research Vitamin Institute and kept the honey stored for six months.

The data obtained showed that the activity of ascorbic acid in linden and buckwheat honey was different, linden honey proving a better medium for vitamin preservation. An interesting fact was revealed in the course of the experiment: 50 per cent of the vitamin C naturally present in honey is lost after six months of storage, but of the artificially introduced ascorbic acid only 10-40 per cent is lost. We, therefore, feel justified in surmising that honey contains some stabilizers preventing vitamin C from oxid-

izing. The physical and chemical properties of honey generally are favourable to the preservation of ascorbic acid.

We chose vitamin C on account of its exceptional lability, but there is good reason to think that other vitamins (B_1, B_2, PP, D, A) can be preserved in honey equally well.

MULTIVITAMIN HONEY FOR PATIENTS WITH DIABETES MELLITUS

Back in 1915 Dr. A. Davydov of Moscow published his observations on the successful treatment of diabetes with honey. His experience in prescribing honey to eight diabetic patients suggested to him the following conclusion: "In many cases of diabetes mellitus, honey can be very useful, first as a sweet; second, as a very nutritious supplement to the diabetes diet, because when the patient eats honey he feels almost no desire to eat any other sweet from among those forbidden for diabetics; third, as a substance preventing acetonaemia which always necessitates the use of sugar and a freer diet; and fourth, as a sugar which does not increase but, on the contrary, decreases the excretion of dextrose (grape sugar)." Numerous investigations by Soviet scientists (L. Cherkes and E. Rosenfeld, Z. Alexer, L. Kashchevskaya, A. Myasnikov, and others) show that vitamins B_1, C and PP in addition to participating in carbo-hydrate metabolism decrease the sugar content in the blood of diabetic patients. So the combination of vitamins B_1, PP and C with levulose can exert a favourable influence on carbo-hydrate metabolism in diabetics and normalize it.

In this respect, attention should be paid to honey containing a high percentage of levulose, such as buckwheat (40.29 to 41.36 per cent) and linden (39.27 per cent). Among honey components there were recently discovered insulin-like hormone substances. All this makes us think it advisable to subject a special kind of multivitamin

honey (containing thiamine and considerable amounts of ascorbic and nicotinic acids) to clinical tests. This honey may prove a valuable addition to the diet of diabetic patients.

There is no doubt that diabetics can be given honey within the norm of carbo-hydrates and that this substitution will prove very beneficial.

MULTIVITAMIN HONEY WITH GLUTAMIC ACID

Glutamic acid* was discovered by Liebig more than a century ago, but its application for therapeutic purposes in diseases of the central nervous system is of a very recent date. Glutamic acid has a very unpleasant taste and often causes nausea and that is why it is usually prescribed in a thick sugar syrup or jam, preserves and the like; sometimes it is given in combination with fructoglucose. The substitution of these by honey has the advantage that by itself honey possesses therapeutic properties.

Especially important is the enrichment of the glutamic acid-honey combination with such substances as vitamin B_1, vitamin B_2, vitamin B_5 (PP—nicotinic acid) and vitamin C, which are vital for the organism as a whole and for the central nervous system in particular. Honey not only neutralizes the unpleasant taste of riboflavin and glutamic acid, but also stabilizes the activity of vitamin C.

We recommend the following prescription for multivitaminized honey with glutamic acid:

High grade (monofloral) honey	100	grammes
Glutamic acid	6	"
Vitamin C	200	milligrammes
Vitamin B_1	4	"
Vitamin B_2	4	"
Vitamin B_5 (PP)	20	"

* Glutamic acid—$COOH.CH_2.CH_2.CH(NH_2).COOH$ is a white crystalline powder melting at 202-202.5°C., soluble in water and non-soluble in alcohol and ether.

We based ourselves on data found in literature concerning the dosage of glutamic acid, while in regard to vitamins we proceeded from the therapeutic dosage recommended by the Vitamin Commission of the Pharmacology Committee at the U.S.S.R. Ministry of Public Health.

MEDUSOMYCES DRINK WITH MULTIVITAMIN HONEY

The refreshing drink in which lives the *Medusomyces gisevi* is very popular in many parts of the U.S.S.R. According to Prof. Hermann Siegwart, the *Medusomyces* drink contains traces of alcohol, acetic acid, great quantities of gluconic acid, choline and some other substances.

Professor L. Kursanov, a well-known Soviet mycologist, has this to say on the subject of *Medusomyces*: "The drink known as 'tea kvass' is produced by the complex *Medusomyces gisevi* organism. It consists of yeasts of the *Torula* type and acetic bacteria closely related to the *Bacterium xylinum*. The action of this organism on sweetened tea consists in that yeasts convert the sugar into alcohol and carbon dioxide while the acetic bacteria oxidize the alcohol into acetic acid. The resultant sourish drink is slightly aerated, and popular medicine regards it as a drug."

Numerous observations show that the *Medusomyces* drink is beneficial to health as its systematic use regulates the activity of the intestinal tract, increases the defensive power of the body and produces a good effect in cases of atherosclerosis and some other diseases. These data of popular medicine were recently corroborated by clinical observations (Professor Jaks of Czechoslovakia, Professor H. Siegwart, Professor G. Barabanchik, E. Zlatopolskaya, and others).

The experiments of Professor G. Shakaryan and Docent L. Danielova have proved that the *Medusomyces* drink possesses high bactericidal properties which do not disappear after an hour's boiling. They think that the

bactericidal activity of the liquid is in direct proportion to the sugar content of the culture medium: with the 10 per cent sugar content it is twice as great as with 5 per cent.

The *Medusomyces* drink is very good for children and it can be recommended instead of aerated water, kvass, lemonade, etc. The interesting observations of E. Zlatopolskaya at the pediatric clinic of the Therapeutics Department of the Second Medical Institute show that the *Medusomyces* drink is a potent remedy for serious ulcerative stomatitis in children. Twenty children up to the age of two and three suffering from the disease were under observation. The *Medusomyces* liquid was used for rinsing the mouth and was also taken perorally: the children between 8 months and one year were given one glass and those over one—two glasses daily. Gauze compresses soaked in the liquid were applied to the ulcerated mucous membrane of the lips. Epithelization was observed two days after the treatment was started and a complete cure set in on the fifth day.

Since honey possesses numerous food and many-sided therapeutic properties we added the *Medusomyces* liquid to it. Our experiments have shown that the most palatable and effective drink is obtained with 5 per cent honey, 5 per cent sugar and an addition of vitamins C and B_1.

A seven- or eight-day-old *Medusomyces* drink with honey and vitamins, bottled, corked and kept in a refrigerator or a cellar, is a pleasant and very useful beverage.

In co-operation with Candidate of Biological Sciences M. Golysheva, we studied the bactericidal properties of *Medusomyces* with different concentrations of honey and sugar. The experiments conducted at the U.S.S.R. Research Vitamin Institute showed that with 5 per cent honey and 5 per cent sugar the liquid is more effective against coliform bacteria than with 10 per cent sugar alone. It should be noted, however, that high honey concentrations inhibit the growth and activity of *Medusomyces*.

We were also interested in the vitamin activity of a *Medusomyces* liquid containing honey and sugar compared with a liquid containing sugar alone. We found that the former contained seven times more vitamin C than the latter.

ARTIFICIAL HONEYS

Academician A. Butlerov, an outstanding chemist and apiarist, wrote: "Sugars as produced by plants are not honey; only after they have been processed in the honey-stomachs of insects and have lost part of the moisture through evaporation, do they become honey." And further: "Honey is the sweet sugary secretions of plants which appear chiefly in flowers and are processed by insects." Thus, the nectar of flowers becomes honey only after it is processed in the honey-stomach of the worker-bee. All other honey obtained without the agency of bees should be considered artificial, that is, not *bee* honey.

In 1887, Layl prepared artificial honey by mixing equal parts of glucose and fructose with cane sugar, fruit, volatile substances and dyes. The analysis of the honey made by Hener showed that its ash content differed from natural honey in that it was devoid of phosphoric acid.

"Biscuit honey"—*Beschuit Honig*—was very popular in Holland. Finkener's analysis showed that it contained 30 per cent oleomargarin, 29 per cent cane sugar, 4 per cent glucose, 7 per cent dextrine, 0.5 per cent soda, 0.5 per cent sand and particles of wood, and 29 per cent water.

The Meinhau Works in Germany produced honey-like syrup, which was called artificial honey. The analysis of the Helfenberg Laboratory discovered in it 29.40 per cent cane sugar, 40.80 per cent invert sugars (glucose and fructose), 0.1 per cent mineral salts and 29.7 per cent water.

Several kinds of artificial honey are produced in the U.S.S.R.

Water-melon honey is obtained from the widely cultivated plant *Citrullus vulgaris Schrad.* According to Professor N. Pavlov water-melon pulp contains 88 to 90 per cent water, 5.5 to 10.5 per cent sugar (mainly levulose), 0.97 per cent nitrogenic substances, 0.6 per cent fat, 0.4 per cent cellulose and 0.36 per cent ash. Water-melon honey contains 41.6 per cent invert sugar (mainly levulose), 14 per cent saccharose, 1.86 per cent ash and 0.34 per cent organic acids. A hundred kilogrammes of water-melons yield seven to ten kilogrammes of honey.

Professor S. Lukhotin used water-melon honey as a stimulant to increase the haemoglobin content of blood. In June-August 1945, he had 15 patients (11 men and 4 women) who were suffering from the sequels of serious wounds under observation in a military hospital. The haemoglobin content of the men was 50 to 63 and of the women 53 to 56. After thirty-two days' treatment with water-melon honey, 14 patients showed a noticeable increase in the haemoglobin content and only in one case did it remain unchanged. The maximum was a 25 per cent increase.

Melon honey is obtained from the plant *Cucumis melo L.* In melons the sugar content depends on the variety, and ranges from 4.5 to 13 per cent. Some late-ripening Central Asian varieties contain up to 17 per cent sugar. Nearly 80 per cent of the melon crop in Central Asia is converted into melon honey, which contains as much as 60 per cent sugar.

Pumpkin honey is obtained from the plant *Cucurbita pepo L.*, the sugar content of which is sometimes as much as 11 per cent. The pumpkin crop from one hectare can yield 25 to 30 centners of honey.

Date honey, obtained from the juice of the date fruit, can keep for two and more years without spoiling.

The method of preparing artificial honeys is as follows: the pulp is separated from the rind and then pressed (usually by wooden presses); the juice is strained through

sieves and cheese-cloth and then evaporated in open copper cauldrons until it is as thick as molasses—or honey.

Artificial honey containing chiefly invert sugars is a wholesome food.

IMPURITIES IN HONEY

Honey is a food which is eaten without any previous treatment (by heat or by any other methods). In their work, beekeepers, therefore, must adhere strictly to rules of hygiene.

Seen under the microscope, a drop of honey reveals pollen grains, yeasts, weeds, microscopic ticks, wax scales, bee hairs and other natural impurities. Slovenly methods of beekeeping may result in soiling honey with ash, sand, dust from inner covers, dead bees, fragments of combs, etc. Careless handling of the bee-smoker may introduce into the combs not only ash and soot, but even drops of tar. If the beekeeper puts the frames on the ground instead of in special clean box, sand will stick to the bottom bars and get into the extractor with them. When the inner cover is torn, dust is certain to get into the hive during manipulation. If honey is extracted in premises where the windows are not protected with netting, bees are sure to fly in and get into the extractor where they are killed.

It is the beekeeper's direct duty to keep his honey pure. Two methods of removing impurities are commonly employed. The first consists in running the honey from the extractor through a sieve with tinned metal netting of various mesh sizes. The second method—settling—consists in heavy particles, such as sand, settling at the bottom, and light ones—wax scales, etc.,—floating to the surface. The vessel used for this purpose is about a metre high and the honey, after it is extracted, is kept in it for three days at a temperature of 18-20°C. The process is quicker at higher temperatures. In a metre-high vessel the

honey is cleared of impurities in 15 days at 10°C., in 6½ days at 15°C., in 3 days at 20°C., in 10 hours at 35°C. and in two hours at 50°C.

After three days' settling the quantity of insoluble foreign particles in honey amounts from 0.008 to 0.012 per cent in ratio to the weight of the honey.

SANITATION AND HYGIENE AT THE APIARY

Hygiene is a science studying the conditions of the external physical and social environment influencing human health. Hygiene elaborates and scientifically substantiates measures aimed at improving these conditions. Sanitation is implementation of hygienic requirements.

The elementary hygienic requirement is cleanliness. The beekeeper's hands must be clean always. Before and after manipulation, he must wash his hands with soap, and after handling colonies affected with European or American foul brood, he must wash his hands thoroughly with soap and a special brush in warm or hot water; the water must be disposed of so as not to cause infection. In order to repel bees, a few grammes of petroleum should be added to the water in the wash-basin. Personal hygiene is essential for everybody, but for a beekeeper it is a must, because the smell of sweat irritates bees and provokes them to sting. The best garment for the work at the apiary is a white overall and a white hat.

Scrupulous cleanliness must be maintained at the apiary; the territory must be cleared of all that is not necessary for work. The beekeeping equipment must be in good repair and always clean.

An untidily kept apiary can never be profitable—there are always sickly and weak colonies and colonies affected with the bee-louse—and all this naturally tells on the honey harvest.

An apiary where the hygienic requirements are observed is free from the wax-moth, rodents, moulds and rust.

Providing the bees with water is of great importance from the point of view of hygiene. It has been established that while bees make from 7 to 15 trips daily to collect nectar and somewhat fewer to collect pollen, they make up to a hundred trips a day for water. The need for water is especially great during the spring and summer period —the time of extensive brood-rearing. Cases have been observed when for lack of water bees threw the brood out of the comb.

A colony with a large number of larvae and pupae needs from 200 to 400 grammes of water a day, and if the beekeeper does not provide his bees with water they are obliged to make thousands of trips in search of it. Besides, bees often take water from undesirable sources.

And yet it is quite simple to ensure bees with water. The device commonly used is a wooden keg with a tap from which water drips continuously on to an inclined board. To make the water run slowly, planks are nailed criss-cross to the board or grooves are hollowed out in it. Directions for constructing this simple device can be found in any textbook on beekeeping.

It is a good practice to add a little salt (50 grammes to a bucket) to the water. The best, however, would be to let bees have a choice between pure and salted water. The experiments conducted at the Golosievskaya Experimental Apiary showed that 47.3 per cent of the bees took pure water, while 52.7 per cent preferred salted water. While bees took water containing 0.5 per cent salt, they did not take water with a salt content of 1 per cent.

Chapter IV

THERAPEUTIC USES OF BEE VENOM

We know from books that Charles the Great and Ivan the Terrible were cured of gout by bee stings. Popular medicine has been utilizing the curative properties not only of honey but of bee venom all along.

In 1864, M. Lukomsky, a professor of the Petersburg Institute of Forestry, published an article on the therapeutic effect of bee venom in rheumatic fever, gout and other diseases. He advised physicians to study this effective drug.

The observations of beekeepers who have used bee venom for various diseases are worthy of special notice. Our own observations over a number of years and the answers to our questionnaire regarding the health of beekeepers show that bee venom is effective both as a medicine and a preventive. It is a known fact that owing to their being frequently stung by bees, beekeepers as a rule do not contract rheumatic fever.

When correctly applied, bee venom is a splendid therapeutic agent.

As yet there is no theory explaining the high therapeutic properties of bee venom. We think that bee venom, which is a very complex biological preparation, acts on the body as a whole, increasing its defensive power.

COMPOSITION, PHYSICAL AND CHEMICAL PROPERTIES OF BEE VENOM

Although beekeeping is an ancient occupation, the chemical composition of bee venom was studied in relatively recent times.

Bee venom is a transparent, pungently aromatic (the odour is not unlike that of honey) and bitter-tasting liquid. Its specific gravity is 1.1313. A drop of bee venom on blue litmus paper changes the colour to red, which shows that it possesses an acid reaction, but a water solution of dried bee venom does not act in this way.

It is common belief that bee venom contains formic acid, because it tastes like that acid, and indeed, analyses have shown that it contains formic, hydrochloric and orthophosphoric acids, histamine, choline, triptophane, sulphur and other substances.

The therapeutic activity of bee venom is probably due to the presence of phosphate of magnesium [$Mg_3(PO_4)_2$], which makes up 0.4 per cent of the weight of dried bee venom, and of sulphur. In addition, traces of copper and calcium have been discovered in the ash of bee venom. It also contains histamine, large quantities of proteins and volatile oils which evaporate in drying. Some researchers hold that it is the volatile oils which cause the smarting pain of a sting. Bee venom dries very easily even at room temperature with a loss of 70 per cent in weight. Dried bee venom is a transparent mass, not unlike gum, and easily dissolves in water and acids. It is not decomposed by a 0.10 N solution of alkali and sulphuric acid even after 24 hours of action. Bee venom changes its properties after prolonged heating with hydrochloric acid or alkali; its activity is reduced by the action of potassium permanganate and other oxidizers. It is very heat-resistant: when dry, heating at 100°C. for as long as ten days produces

no noticeable effect on it. Bee venom is at the same time cold-resistant: freezing does not reduce its toxicity.

Dried bee venom, if protected from moisture, can retain its toxic properties for several years.

BEE VENOM AS AN ANTISEPTIC

Professor G. Gause considers bee venom one of the most effective antiseptics. P. Komarov, A. Erstein, A. Balandin, I. Koop and other Soviet researchers have established that a 1 to 50,000 water solution of bee venom is sterile. Paramecia (ciliate infusoria) have been observed to perish instantly in a 1 to 10,000 solution of bee venom and in a 1 to 50,000 solution—in thirty seconds. But solutions of bee venom ranging between 1 to 500,000 and 1 to 600,000 stimulate their proliferation. This shows that bee venom solutions of different degrees of dilution possess different biological properties.

I. Koop has justly said that "bee venom, which is easily obtained, deserves no less attention of the medical profession than antibiotics of fungal and bacterial origin."

SUSCEPTIBILITY TO BEE VENOM

When a bee stings it introduces into the skin a transparent drop of venom which possesses therapeutic properties. The advantages of bee venom over other drugs lie in its quick action and in the immense difference between the therapeutic, toxic and lethal doses. The toxic dose of bee venom is dozens of times, and the lethal—hundreds of times, greater than the therapeutic.

Susceptibility to bee venom is different in different persons, women, children and old people being more susceptible.

Observations show that healthy persons can easily stand five and even ten simultaneous stings; they cause only a local reaction—a slight swelling, a reddening of

the skin, a burning pain; 200-300 simultaneous stings lead to the poisoning of the organism with the characteristic signs of disturbances of the cardiovascular system (asthma, cyanosis, accelerated pulse, convulsions, paralysis); 500 simultaneous stings are fatal, death ensuing usually from respiratory paralysis.

Some people, however, are so susceptible to bee venom that a single sting is sufficient to cause general indisposition, headache, nettle rash, vomiting and diarrhoea.

Here are a few examples.

Patient M. was stung by a bee and immediately felt unwell. Her head began to ache and her temperature rose and she was compelled to take to her bed. She felt better on the next day.

While he was extracting honey, patient K. was stung by a bee in the bridge of his nose. Half an hour later his whole face became swollen and there were swellings on other parts of his body. His temperature rose to 39.5°C. He could not work all that day.

Numerous observations show that stings do not affect persons who work with bees for long periods (some veteran beekeepers have been stung by as many as a thousand bees and showed no symptoms of poisoning). Most people become quickly inured to bee venom and do not react to stings.

The table on the next page gives the data from the questionnaires answered by Soviet beekeepers and shows how long they took to become immune to bee venom.

It has been proved with experiments that people who have been keeping bees for a long time and, consequently, been frequently stung by them become immune to bee venom, because of special substances that appear in their blood. The experiments were simple and convincing. Of two test tubes one contained the blood serum of a person, who had been keeping bees for a long time, and the other contained an equal quantity of serum of a person who had never been stung by a bee. A solution of bee venom was added to the two test tubes. The serum of the beekeeper neutralized the action of the venom; no such effect was

Percentage of beekeepers	Period of work at apiary in the course of which immunity was acquired
28.2	less than one year
22.5	in the course of first year
12.1	" " " 2 years
10.5	" " " 3 "
2.2	" " " 4 "
3.8	" " " 5 "
0.9	" " " 6 "
1.5	" " " 7 "
1.3	" " " 8 "
0.1	" " " 9 "
1.9	" " " 10 "
0.2	" " " 11 "
0.2	" " " 12 "
1.7	" " " 15 "
0.2	" " " 20 "
4.2	had congenital immunity
5.7	failed to acquire immunity
2.4	did not remember when immunity was acquired
0.4	did not answer this question

observed in the second test tube. Experiments on rabbits also showed that the blood serum of beekeepers neutralizes the local action of bee venom, while normal human serum does not possess that property.

Frequently, not all the members of a beekeeper's family react identically to bee stings. Literature, however, offers us no description of cases of congenital immunity. The following examples may prove of some interest in this connection.

I. Pozdnyakov, a beekeeper in the village of Sopron, Kursk Region, wrote us a letter describing in detail how in 1947 his one-year-old son was attacked by a huge number of bees (at least 300). The child's face and body were covered with stings and became so swollen that it was feared he would die. But three days later the swelling

subsided, and on the sixth day the boy recovered completely.

Subsequently, it was learned that during her pregnancy, the boy's mother was often stung by bees. That allows us to suppose that the child had inherited immunity to bee venom from his mother and was thus able to bear the great number of stings. The boy is strong and vigorous and no longer reacts to bee stings.

The writer of the letter also noted that his boy never fell ill after that, although his playfellows had measles, scarlet fever and other diseases.

It has long been known (and literature data confirm it) that owing to immunity to bee venom beekeepers are less apt to contract some infectious diseases. Back in 1914, O. Lamonova wrote that thanks to having been stung by bees her seven-year-old daughter did not catch measles from a playmate with whom she was in constant contact all the time the latter was ill with this extremely infectious disease.

I. Ionov of Leningrad Region, who had been keeping bees for half a century, wrote to us about the following very interesting observation. His wife was very sensitive to bee venom: stings caused swellings and acute pain. Her two daughters, born in 1903 and 1908, also were highly sensitive to bee venom. But the two sons, born in 1918 and 1932, were quite immune to it. Ionov thinks that his sons' immunity can be explained by the fact that while his wife was pregnant in 1918 and 1932 she was frequently stung by bees.

The extensive material we have collected (questionnaires and letters), as well as personal observations over many years, convince us that bee stings or the introduction of apitoxin* into the human body result in insusceptibility not only to bee venom, but also to some infections, in the first place, to rheumatic fever.

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* From the Latin *apis*—bee and *toxin*—venom.

The widespread opinion that the children of beekeepers are congenitally insusceptible or quickly become insusceptible to bee venom has not been corroborated by our questionnaires.

TREATING VARIOUS DISEASES WITH BEE VENOM

TREATMENT OF RHEUMATIC FEVER

We have received many letters from beekeepers who had rheumatic fever and have been cured by bee stings. The answers to questionnaires sent to apiarists throughout the Soviet Union in 1950-51 give many examples illustrating this. Here are a few of them.

R. suffered from rheumatic fever and was prescribed rest and conventional treatment. His condition did not improve, he was bedridden because of pains and swollen joints. He decided to try a popular remedy—bee stings. He was taken to an apiary where he was repeatedly stung by bees and recovered in the course of one summer; no recurrence of the disease has been observed for the past few years, he has been free from attacks.

V. fell ill with rheumatic fever in 1935 and conventional treatment, both medicamental and physiotherapeutic, proved ineffective. In 1938, he began keeping bees and their stings cured him in the course of a single summer. The disease has not recurred since.

M. had been suffering from a serious form of rheumatic fever from childhood (he could not move about unaided). Treatment with bee stings was started, and after two summers he got well. Two or three years later his joints again showed swellings and pain returned. The bee-sting treatment was repeated and a complete cure followed.

K. contracted rheumatic fever in 1945. The disease affected his extremities. He received treatment at home, went to health resorts, such as Naftalan, Tskhaltubo, Pyatigorsk and Zheleznovodsk. He would feel better after a course at a health resort but two or three months later the disease would return. In 1952, he took a course of treatment with bee stings, recovered, and at the time of writing to us (1953) was free from attacks of the disease of which he had been victim previously for three or four months every year.

In their works many physicians speak of the effectiveness of bee venom as a curative agent in rheumatic fever,

In 1897, I. Lyubarsky, a Russian military surgeon, published a long article entitled "Bee Venom as a Curative Agent," in which he drew the conclusion on the basis of experience of many years that bee venom was a very good remedy for rheumatic fever.

F. Tertsch, a well-known Viennese clinicist, suffered from rheumatic fever and was cured by chance bee stings. He became interested in bees and the properties of bee venom and began using it in the treatment of rheumatic patients. In 1888, he published a work in which he described 173 rheumatic patients who had been cured of the disease by bee stings.

In 1912, Rudolph Tertsch, a Viennese ophthalmologist, published an extensive work on the treatment of rheumatic fever with bee venom. Out of a total number of 660 cases, 544 were completely cured, 99 showed marked improvement and only 17 failed to benefit by the treatment. The author remarked that the latter two categories (116 cases) included patients with advanced or neglected disease and also those who had not completed the course of treatment.

Clinical observations show that bee venom is a specific drug for true rheumatic fever, the Sokolsky-Bouilleau disease, when the patients endure bee stings well. But in persons suffering from infectious arthritis of syphilitic, gonorrhoeal or tuberculous origin, bee venom causes serious local and general reactions. This has suggested to some clinicists the use of bee venom as an aid in the diagnosis of genuine rheumatic fever.

BEE VENOM FOR NEURITIS AND NEURALGIA

Popular medicine has long been aware of the effectiveness of bee venom in various nervous diseases. Special magazines and other periodicals on beekeeping frequently carry articles on this problem contributed by beekeepers.

The material at our disposal, as well as our own observations, confirm this view. Here are a few illustrations.

T. developed sciatica in 1944 and recovered only in the summer of 1945 after he had started working at an apiary where he was often stung by bees.

P. suffered from neuralgia of the trigeminous nerve since 1945. After some time the pain became so acute that he had difficulty taking even liquid food; there were moments when he could not speak. Treatment with bee stings brought about a cure.

L. developed sciatica in 1933. Heat treatment and drugs failed to effect a cure. He recovered soon after he began treatment with bee stings.

We could give many more examples to show the effectiveness of bee venom for neuritis and neuralgia.

On the suggestion of Academician M. Krol and under his guidance, Dr. K. Yerusalimchik applied bee venom in diseases of the peripheral nerves at a clinic in 1938. Most of the patients suffering from sciatica and neuralgia of different localization had had rheumatic fever and previous to bee-venom treatment had undergone medicamental or physiotherapeutic treatment.

Here are two cases from Dr. Yerusalimchik's article.

Y., 36, entered on August 2, 1938, with exacerbation of radiculitis. Complained of acute pain in the lumbar region and left leg along the course of the sciatic nerve. On February 21, 1938, had lifted a great weight and instantly felt pains in the back and left leg. Walked with a limp; palpation of the spine revealed painfulness in the region of fifth lumbar vertebra. Movements limited, especially in the forward direction, excessive sensitivity along the sciatic nerve on the left, intensive sweating. Urine, blood and spinal fluid normal. X-ray picture of the lumbar region showed no marked alterations. Treatment: subcutaneous injection of apitoxin in the most painful sites. After six injections the pain abated and the patient was allowed to resume work.

M., 42, entered on August 10, 1938, complained of acute pain along the course of the right sciatic nerve. Had been ill for three years with exacerbation for the late six weeks. Treatment at an outpatient clinic failed to effect a cure. Objective data: pain along the sciatic nerve, slight scoliosis, pain at palpation in the region of fifth lumbar vertebra and in the paravertebral points to the right, movements of the spine restricted. Excessive vascular lability manifested by alternating reddening and paling of the skin. Coldness of the right limb. Laboratory and X-ray investigations showed no alterations.

Treatment with subcutaneous injections of apitoxin solution in the most painful sites. Pain abated after one or two injections. Objective and subjective condition greatly improved after three or four injections. A complete cure was effected after eight injections and the patient was allowed to resume work.

BEE VENOM FOR SKIN DISEASES

Bee venom is effective in the treatment of various skin diseases as the following examples show.

U. suffered for a long time from furunculosis of the face. Medicamental treatment (with ichtyol, streptocide and sulphidine ointments) failed to cure her and she decided to use a popular remedy—bee venom—which proved effective.

S., a child, had tuberculosis of the skin (lupus) for five years. One day a bee stung the affected cheek and soon the skin around the spot grew pale. After that, the child was given bee-venom treatment. The affected cheek gradually took on a healthy colour and complete recovery ensued six weeks after the treatment was started.

BEE VENOM FOR MALARIA

In 1864, Professor M. Lukomsky of the Petersburg Forestry Institute published an article on the effectiveness of bee venom in the treatment of malaria.

In 1861, a Dr. Schulz announced that he had used bee venom in the spring of 1859 for tropical, tertian and quartan malaria.

Further observations have proved the correctness of these assertions.

P. contracted malaria in 1934. Some time later he began working at an apiary where he was often stung by bees, which led to a cure.

E., a child, was ill with malaria for several months. A beekeeper advised bee-venom treatment which proved effective.

S. lived in Central Asia and from 1945 to 1947 suffered from tropical malaria. In 1947, he began to work at an apiary where bee stings cured him of the disease.

Z. suffered from malaria in 1947. Ten bee stings proved sufficient to cure her of the disease.

The problem of treating malaria with bee venom is very important and deserves thorough investigation, yet even the incomplete data at our disposal enable us to say that in certain cases apitoxin can be used in a complex of anti-malaria measures.

BEE VENOM FOR OCULAR DISEASES

Bee venom is an old popular remedy for some ocular diseases. Today it is successfully used in iritis and iridocyclitis. Docent O. Shershevskaya applied bee-sting therapy at the Ophthalmologic Clinic in Novosibirsk with excellent results. She writes that "in cases of serious iritis, when vision fell to 0.001 per cent, the application of bee venom yielded astonishing results: the inflammation subsided and in three or four days a complete cure was brought about and normal vision restored."

BEE VENOM FOR EXOPHTHALMIC GOITRE

Since neither medical nor special bee literature contains instances of exophthalmic goitre being cured with bee venom, the following examples illustrating the successful treatment of this disease with apitoxin are especially interesting.

G. had been suffering from Basedow's disease since 1932. Up to 1948 she underwent medicamental and physiotherapeutic treatment with no results. She took the advice of a beekeeper and began treating herself with bee stings. After a few stings she felt much better, the swelling diminished and soon disappeared altogether.

C. suffered from exophthalmic goitre, was operated, but four years after the operation the disease recurred. Then she noticed that in summer, while she was working at an apiary where bees stung her, she felt much better than in winter.

We may add that exophthalmic goitre is a rare disease among beekeepers.

HOW BEE VENOM AFFECTS BLOOD PRESSURE

The fact that bee venom decreases blood pressure is well known to popular medicine. Experiments with animals have proved this. When the poison of a bee was injected intravenously to a dog some decrease of the blood pressure was observed; the injection of the poison of several dozens of bees resulted in a sharp decrease of the blood pressure. This is due to the dilatation of the peripheral blood vessels caused by the presence in bee venom of histamine, a vasodilative agent. Pharmacological experiments show that even a 1 to 250,000,000 solution of histamine can produce a biological effect.

Here are a few examples to illustrate the effectiveness of bee venom in decreasing blood pressure.

K. had hypertension for five years. In 1948, she began to work at an apiary where she was often stung by bees. Soon her condition improved and her blood pressure fell considerably.

L. suffered from hypertension, his blood pressure was 230/170 millimetres. Medicamental treatment was ineffective and he decided to try popular remedy—bee venom. He let himself be stung by bees and a year of this treatment brought about a marked improvement: his headaches disappeared, he became less irritable and felt fit for work. His blood pressure fell to 140/110 millimetres.

S. suffered from hypertension developed in 1946; his blood pressure reached 180/120 millimetres. In 1948, gripping pains appeared periodically in the frontal part of the head. He was treated at a clinic, but the pains disappeared at rest without any treatment. In 1953, he was hospitalized in Dniepropetrovsk and was discharged some time afterwards in an unsatisfactory condition. Then he subjected himself to bee stings and in a short time his blood pressure fell to 140/90 millimetres.

It should be added that besides the action of apitoxin, the very fact that the patient stays in the apiary, enjoys fresh air and quiet, cannot but exert a favourable action on his condition.

INDICATIONS AND CONTRA-INDICATIONS TO THE USE OF BEE VENOM

Some beekeepers hold bee venom to be a universal cure and advise its use for gynaecological, pediatric, and even

venereal diseases. That is positively wrong, because in some diseases bee venom is contra-indicated.

Soviet laws forbid persons who have no medical training to practise medicine and thus only a physician has the right of prescribing bee-venom treatment.

Popular medicine, clinical observations and answers to our questionnaire show that bee venom possesses varied therapeutic properties. It is particularly effective in rheumatic affections of joints, muscles and the heart, in chorea, inflammations of the sciatic, femoral, facial and other nerves, and some other diseases.

Caution must be exercised in the use of bee venom, particularly in the case of children and old people who are very sensitive to it.

The use of bee venom is contra-indicated in some diseases, such as tuberculosis, diabetes, atherosclerosis, venereal diseases and congenital heart diseases.

If after the first sting a patient feels general weakness, has fever, headache, nettle rash, a buzzing in the ears, diarrhoea, etc., further treatment with apitoxin must be discontinued.

METHODS OF BEE-VENOM THERAPY

In administering bee venom a bee is taken with tweezers and applied to the corresponding site on the human body in accordance with the scheme on Fig. 12*. The part of the body to be stung must be washed with warm water and soap, but not rubbed with alcohol. After stinging, a bee flies away, leaving behind her sting with the sting apparatus which continues to contract for several minutes until the poison-sack is empty. The sting, therefore, should

* The scheme is useful in that stings are applied to the same parts of the body after intervals of five days, so that any swelling, itching, etc., has time to pass off during the intervening four days; the patient usually feels well and apitoxin therapy can be continued.

be removed only after the poison has entered the wound. The contraction (and the end of contraction) of the sting apparatus can be seen with the naked eye. After the sting has been removed the wound can be covered with any indifferent ointment.

Bee venom should be used in accordance with the following time-table: on the first day a patient is stung by one bee, on the second, by two, on the third, by three, and so on until the tenth day when he is stung by ten bees. This is the first course of treatment, during which the patient receives 55 stings. The first course is followed by an interval of four or five days, then the treatment is resumed with three bees stinging daily in the sites indicated on the scheme. During the second course of treatment of six weeks' duration the patient should receive venom from 140 to 150 bees, altogether for two courses—from 180 to 200 bees. If after the two courses no cure or marked improvement is observed the treatment should be discontinued.

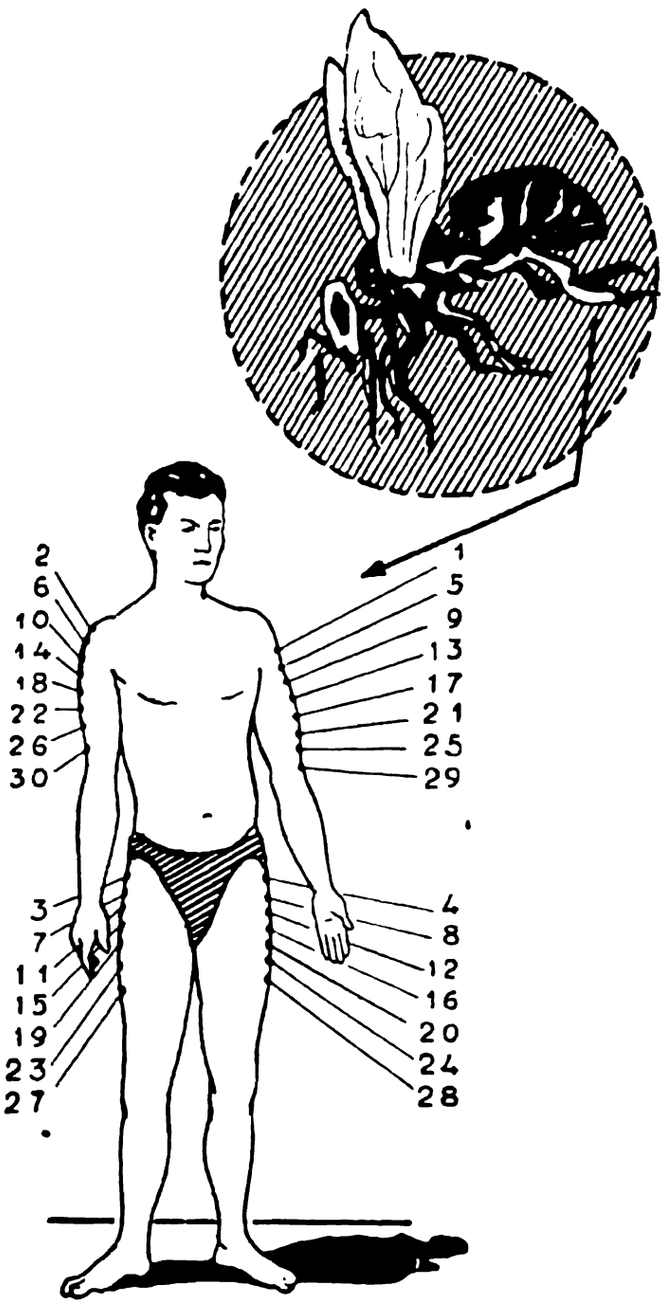

Fig. 12. Diagram of application of bee stings. Figures show the sites where bees should be applied, and the sequence of days

It is a remarkable fact that patients for whom bee venom is indicated usually have no swellings and feel no

pain after they are stung by bees. Even when stung by 20 to 30 bees simultaneously such patients do not suffer much. When, however, their health improves and a complete cure is about to take place, some of the patients show local reactions (reddening of the skin, swelling, pain) after a few, or even one, sting.

A PORTABLE DEVICE FOR APITOXIN THERAPY

Bees taken from the apiary to be used for bee-venom treatment can live in a box for not more than one day. This prevents many patients from taking a regular course of

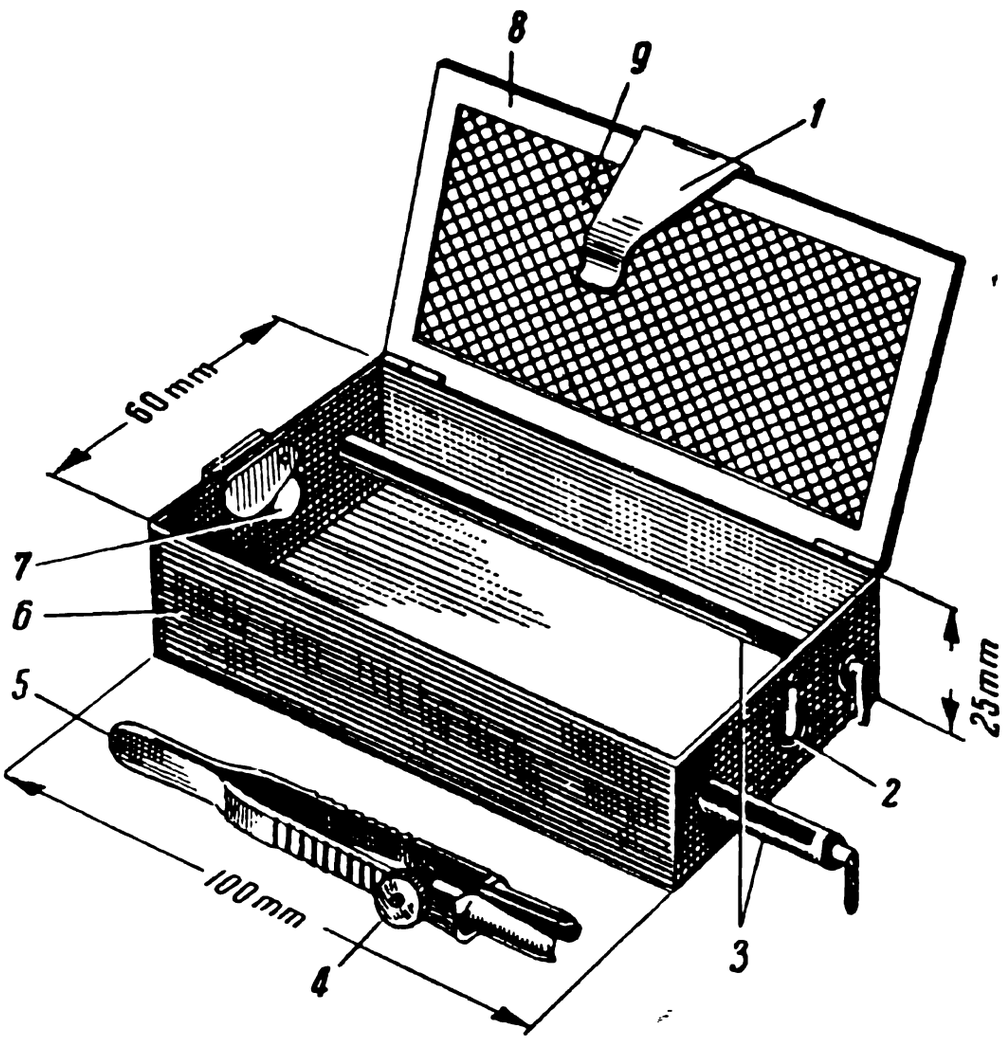

Fig. 13. Drawing of a portable device for apitoxin therapy:
1. Clasp of box. 2. Bee escape (the door is shut); 3. Movable feeders; 4. Screw of special tweezers; 5. Special tweezers for picking bees; 6. Body of box; 7. Bee escape (the door is open); 8. Lid of box; 9. Wirework net of lid

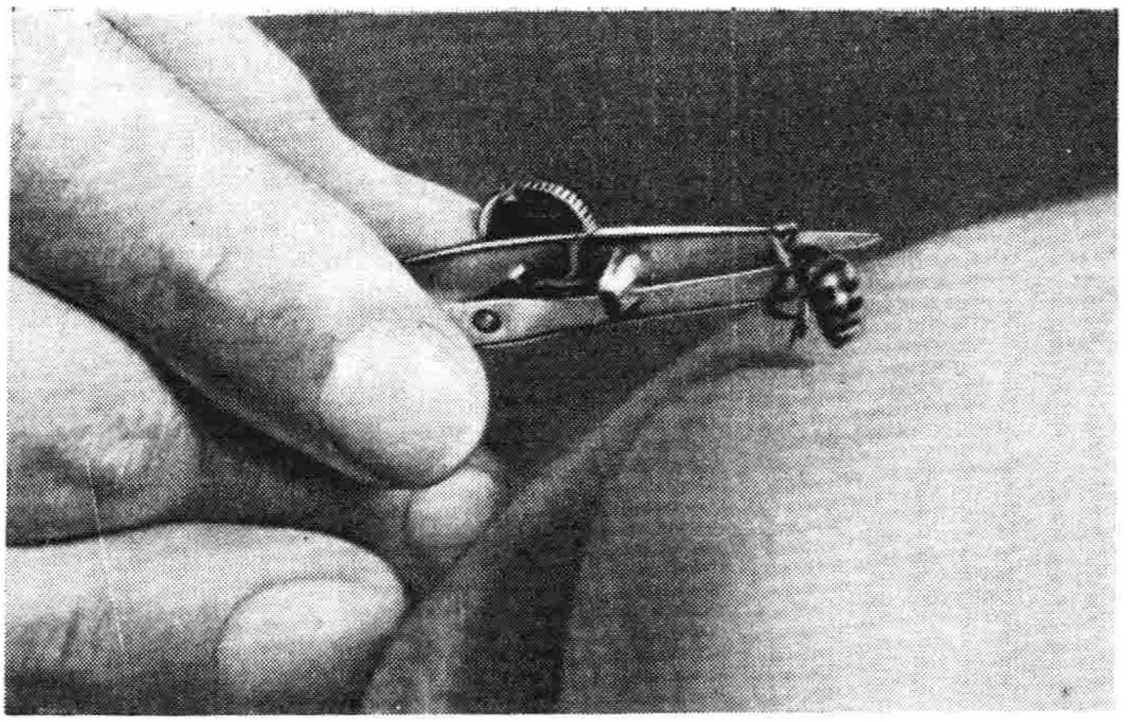

Fig. 14. Applying live bee to patient's skin with special tweezers

treatment, because they are obliged to go to the apiary every day or every other day. That is why some patients keep in their houses a nucleus (a small beehive).

When a bee is to be caught, she is let out of the hive or box, when she usually flies to the source of light, most often to the window, and the operator tries to catch her by the thorax or wings. Often, however, it is the operator who is stung. Anatomic pincers, too, are not useful in this, because if squeezed ever so slightly, a bee protrudes her sting and discharges venom before she is put on the part of the patient's body to which the sting is to be applied.

So we have elaborated a portable device consisting of a wire-net box (Fig. 13) where the bees can live for several days (as long as four or five) and a pair of special tweezers. The box can hold up to a hundred bees and enough food (honey or sugar syrup) in the two feeders which can be refilled without opening the box. It is fairly warm inside. When a bee is to be taken out, a side door is slid,

a bee appears and is easily grasped with the tweezers (Fig. 14).

This portable device is convenient for transporting bees and also facilitates the production of pure bee venom for laboratory and therapeutic use.

INTRADERMAL INJECTION OF APITOXIN

The above scheme of apitoxin treatment can be used by a patient who receives bee stings at home on the advice of a physician.

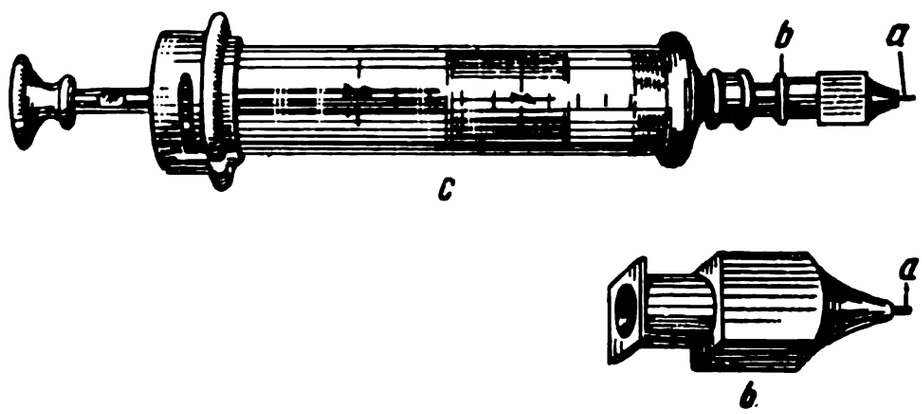

Fig. 15. Special needle (a) with clutch (b) attached to syringe (c) for apitoxin therapy

Recently, a method of intradermal injection of apitoxin was elaborated, facilitating the use of bee venom at hospitals, clinics and other medical institutions. This method has an advantage over the one described above in that it makes it possible to vary the method of treatment for each patient.

Intradermal injection of apitoxin has proved the most effective, for when bee-venom solution is introduced between the epidermis and the derma, where one-fifth of the blood circulates, the venom is immediately carried over to the whole body. Considerable doses of bee venom can be

injected subcutaneously (up to 1 ml.), but the therapeutic effect is less satisfactory than that achieved with intradermal injection. When the latter method is used, bee venom is diluted in saline or in distilled water and injected in small doses (0.1, 0.2 and 0.3 ml.) with a special needle supplied with a clutch (Fig. 15). The needle is somewhat longer than a bee sting.

IONOPHORESIS (ELECTROPHORESIS) OF APITOXIN

When taken perorally, apitoxin does not produce the desired effect, because it is highly sensitive to the action of the gastric and intestinal enzymes which annul its therapeutic activity.

Bee venom must not be introduced intravenously, as it may cause an intensive and dangerous reaction.

Intradermal, subcutaneous and external application of bee venom is widely and successfully used but is not entirely reliable.

Ionotherapy or electroionotherapy—the introduction of drugs into the body by means of direct electric current—is used to introduce (without punctures) adrenaline, cocaine, dionine, atropine, caffeine, histamine, folliculine, suprarenine, etc. In ionotherapy the drug is introduced into the blood stream through the intact skin (Fig. 16); this method is widely used in the treatment of internal, nervous, surgical, gynaecological and other diseases.

Member of the Academy of Medical Sciences of the U.S.S.R. Professor N. Vershinin noted that among the various methods of introducing drugs through the skin, ionophoresis—a method based on electrolytic dissociation—is the optimal.

Observations show that bee-venom treatment by means of ionophoresis has some advantages over direct appli-

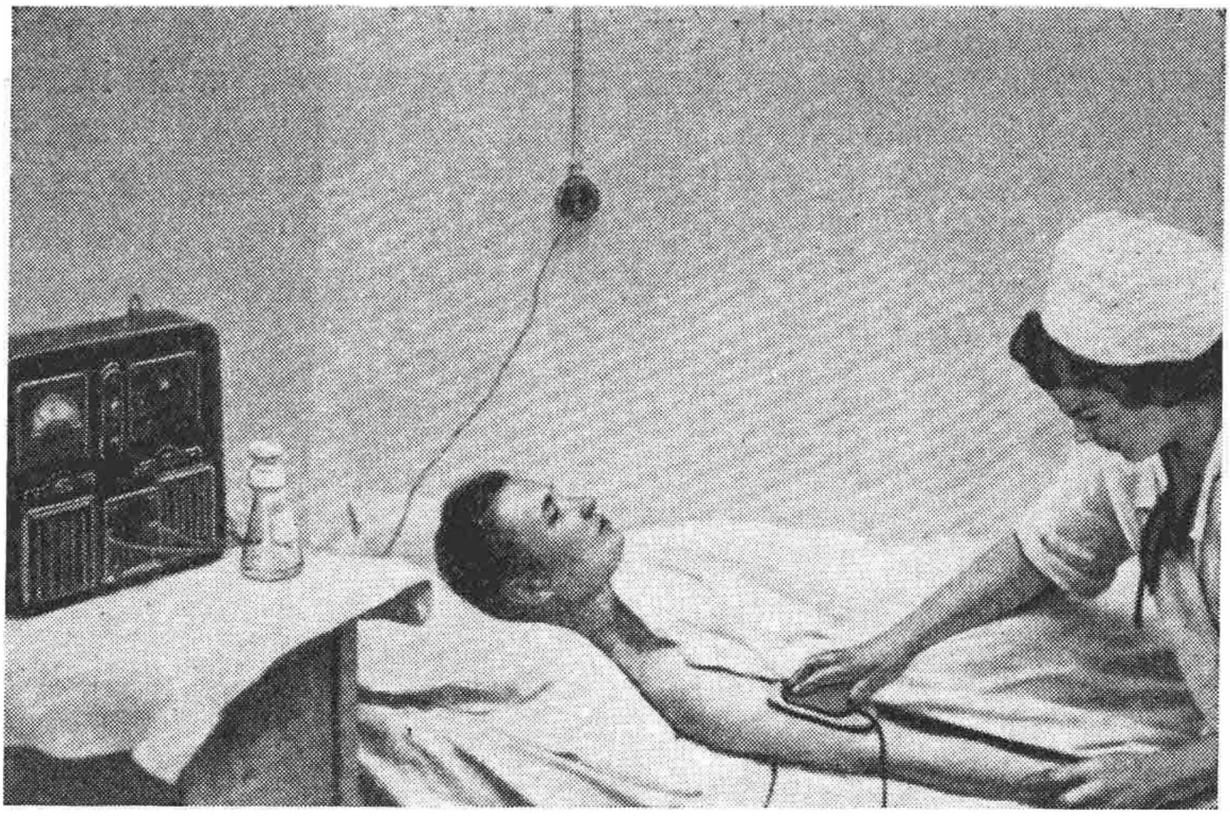

Fig. 16. Electrophoresis of apitoxin

cation of bee stings, because it is done in medical institutions under the supervision of physicians.

The ionophoresis method of introducing apitoxin solutions is simple, and where there is the necessary equipment it can be used at all medical institutions.

Bee-venom treatment by means of ionophoresis is accompanied by no unpleasant sensations with the exception of a slight hyperaemia in the parts of the skin subjected to ionophoresis.

APITOXIN OINTMENT

Another method of applying bee venom is to rub in apitoxin ointment. The ointment is prepared from pure apitoxin, liquid paraffin and salicylic acid. The acid softens the outer layer of the skin (epidermis) and increases its permeability. As bee venom can enter the blood only through skin lesions the ointment contains minute crystals

of silicate which puncture the skin. A patient to whom the ointment has been prescribed can apply it at home under the general supervision of his out-patient clinic. The adverse property of the ointment is that it produces lesions of large areas of the skin; the effectiveness of the intradermal and ionophoresis methods is much higher than that of the external application.

BEE-VENOM INHALATION

Human lungs consist of 3,000,000 air vesicles with a dense network of blood vessels on their walls. It has been calculated that the aggregate surface area of the air vesicles is nearly forty square metres. That is why adsorption through the lungs, especially of drugs, proceeds twenty times quicker than through the intestinal tract, and if apitoxin treatment is indicated the inhalation method may prove very effective. The method is simple and can be used in any medical institution. It consists in water vapour drawn from the ordinary inhaler (Fig. 17) carrying with it the vapours of bee venom which are inhaled by patients through a porcelain tube, but the details of its application are still being investigated.

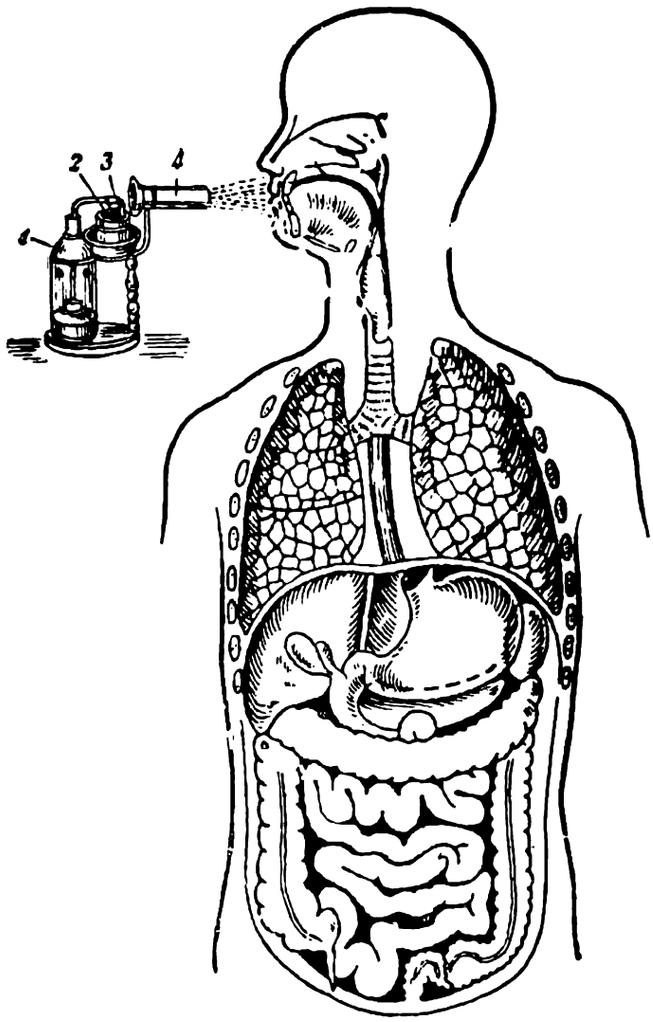

Fig. 17. Diagram of bee-venom inhalation:
1. Reservoir of steam inhaler filled with water; 2. Glass with solution of apitoxin; 3. Tube along which apitoxin is carried with the vapour; 4. Porcelain or glass tube from which the patient inhales bee-venom vapour

FIRST AID IN BEE-VENOM POISONING

Descriptions of the action of bee stings are not numerous in literature and we think that the following data will be of some interest.

Some twenty years ago, Dr. M. Aviosor was urgently called to P., a woman who had been stung on the crown of her head by a bee. She was unconscious, the skin of the face and the mucous membranes were intensely cyanotic, she breathed with a gurgling sound through clenched jaws and saliva was dripping from the corners of the mouth. The pulse was scarcely perceptible. To stimulate the heart activity, camphor was injected, and a piece of cotton wool soaked in ammonia was pressed to the stung area. When the patient regained consciousness she felt overcome by nausea and by the evening her temperature rose to 37.5° C. Some time passed before she recovered. In describing this case Dr. Aviosor said: "I mention this case in order to show my colleagues that the sting of such seemingly harmless insects as bees may be almost lethal."

In 1934, Dr. I. Beilina described a case when nearly forty bees simultaneously stung the hands of a man of a sturdy constitution who had been keeping bees for a long time. The beekeeper removed the stings and went on working, but some twenty minutes later he felt ill, his face turned greenish-pale, he was overcome by nausea and saliva began to drip from his mouth. Then he lost consciousness and began to come round only two hours later. He spent the rest of the day in bed. The following two days he felt weak, asthenic and had spells of dizziness.

In an article published in 1937, Professor P. Alisov described the case of a man who was stung on the tongue. "At eight p.m., A. was drinking tea with jam cakes. He had just bitten into a cake when he felt his tongue pricked as with a needle. He spat out the piece of cake and found a wasp in it. The pain rapidly gave way to a burning sensa-

tion and the tongue swelled so much that the victim could move it only with great difficulty.

"Cold baths and rinsing with a solution of potassium permanganate made the swelling subside, the tongue regained almost its normal size, but the difficulty in moving it remained for a few days."

Consequently, in people with increased sensitivity to apitoxin bee stings can cause serious morbid conditions. Many remedies are said to be effective for bee stings. Here are some of them.

Georges de Layens and Academician Gaston Bonnier, the French scientists, say that "the first thing to do on being stung by a bee is to remove the sting, suck the poison out and compress the skin around the lesion; then cold water should be applied to the stung area and the lesion should be rubbed with onion. Parsley leaves, wormwood, mint, fresh honeysuckle berries, vinegar with water, water with quicklime, volatile alkali or a drop of phenol, lysol, thymol, are all good for alleviating pain."

Professor P. Alisov says that the Tajiks, Uzbeks and inhabitants of Bokhara treat bee stings with onion, garlic, a brew of plane leaves, etc.

Actually most of these remedies are ineffective and some of the usually recommended remedies (damp earth, clay, etc.) are even harmful, as they can introduce tetanus infection or cause septicaemia.

The longer the sting remains in the wound, the more poison penetrates into it. A bee that has just stung obeys her instinct and hastens to fly away, but the recurved barbs keep the sting firmly rooted in the victim's skin and the bee can fly only by leaving the sting behind. The sting apparatus separated from the bee's body contains the poison-glands, the poison-sack and the end ganglion of the segmental ganglia which makes it contract even when it is separated from the bee's body. This automatic contraction of the sting muscles drives the sting deeper into the skin and the content of the poison-sack continues to flow even

if the sting has been torn from the bee and just placed on the skin. Therefore, in order that the wound should receive as little venom as possible, the sting must be removed with the utmost speed, but, of course, elementary rules of hygiene such as clean hands and objects used to remove the sting must be strictly observed to prevent infecting the wound. When the sting has been removed, the stung area should be covered with alcoholic calendula liniment, pure 96 or 70 per cent alcohol, a 1 to 1,000 solution of potassium permanganate, ammonia, iodine, or pure ungranulated honey.

We suggest the following remedy (approved by the Pharmacological Committee of the Scientific Council at the U.S.S.R. Ministry of Public Health): remove the sting with its poison-glands and poison-sack with the aid of special pincers and apply to the stung area a liniment prepared from calendula, pure alcohol and paraffin (or lanoline). The pincers permit the quick removal of the sting with the store of venom almost intact and calendula in combination with pure alcohol quickly alleviates pain and itching.

For the convenience of beekeepers, it is our suggestion that the special pincers be kept in a small portable case. In addition to pincers the case should contain a glass bar, cotton wool, calendula liniment, instructions for use and a looking-glass. The looking-glass is necessary when stings are to be removed from the face, neck, and so forth, and there is nobody to help the beekeeper.

In serious cases, when there are signs of cardiovascular or nervous disturbances the sting victim must lie down and take perorally a 40 per cent solution of alcohol which is very effective. Still more effective is a dose of 25 to 50 grammes of alcohol with honey (20 grammes honey to 200 grammes alcohol). The patient should also be given a honey and vitamin drink made of 100 grammes honey (any kind except honey dew), a litre of boiled water and

500 milligrammes of ascorbic acid (vitamin C), stirred and kept in the cold in a corked glass vessel.

If the sting victim shows signs of heart failure, he should receive injections of stimulants—camphor or caffeine—and when signs of nervous excitement are observed, he should receive a sedative or hypnotic, such as bromide, luminal or veronal. Cold baths or lotions of boric acid solution (a tea-spoonful of acid to a glass of water) should be applied to the stung areas.

During the first day sting victims usually prefer a diet of milk and honey or fruits and honey.

A sting in the eye is very dangerous, because the sting may cause lesions of the eye. The eye immediately swells, an acute conjunctivitis develops and is accompanied by unbearable pains. The attention of an ophthalmologist must be secured as soon as possible. Extracting the sting from the eye is a very responsible task, for if a fragment of it is left in the eye (most often in the cornea) an operation will be inevitable.

METHODS OF OBTAINING BEE VENOM

Upon emergence from her cell, a young worker-bee has very little venom in her poison-sack. In the course of time the store of venom increases and reaches the maximum in a fourteen-day-old bee. About the fifteenth day of a bee's life her poison-glands undergo a regression.

I. Komarov and A. Erstein state that a bee can yield 0.085 milligramme of venom. The quantity of venom in bees depends also on the season: in spring and summer it is the greatest, diminishing in autumn and especially in winter. The food which the bee consumes decisively influences the secretion of venom: foods with a high carbohydrate content yield less venom than protein foods.

There are several methods of obtaining venom. The simplest consists in taking a bee with a pair of tweezers by the thorax or the wings; then she makes an attempt

to sting and a tiny drop of venom appears on the tip of her sting. This drop can be collected on a watch-glass, slide or filter paper, or the tip of the live bee's sting can be dipped into a test tube with distilled water; the venom is very water-soluble and the solution can be used for medicinal purposes at once.

Some investigators recommend tearing the sting from a bee together with the poison-glands and poison-sack, drying it and grinding into a powder. Before the powder is used it is dissolved in water.

Here is another simple method of obtaining venom: a clean glass jar with a wide mouth is filled with distilled water and covered with a membrane of animal origin, then a live bee is put on the membrane and made to sting it. The sting punctures the membrane and is separated from the bee's body along with the sting apparatus. The contents of the poison-sack are gradually emptied into the water. When the desired quantity of venom has been collected, the water is evaporated and the venom preserved. The sting apparatus may be simply put into water and the solution obtained can be used for bee-venom treatment. In all these methods, the bees yielding the venom die.

There is a method based on narcoticizing bees. A great number of bees are put into a clean glass jar covered with filter paper soaked in ether (Fig. 18). The ether vapours excite the bees and before they become narcoticized, they cover everything around them, including the walls and bottom of the jar and one another, with drops of their venom. When the bees are in deep narcosis the jar is rinsed with water, the turbid liquid is filtered, evaporated and the residue, composed of dried venom, keeps well for several months. The bees are then dried in a warm room or in the sun and returned to the hive.

This method has some advantages as with its aid large quantities of venom can be obtained without killing the bees. A thousand live bees can yield 50 to 70 milligrammes of venom. And yet experiments and observations show that

narcosis of bees has its drawbacks: the bees do not yield all the venom contained in their poison-sacks, and many of them die; it is extremely difficult to obtain pure apitoxin by this method.

The common fault of all these methods is that they consume a great deal of labour and time and immense numbers of bees die or wear away quickly. The setting-up of one or two or even dozens of big pharmaceutic apiaries cannot satisfy the growing demand for venom.

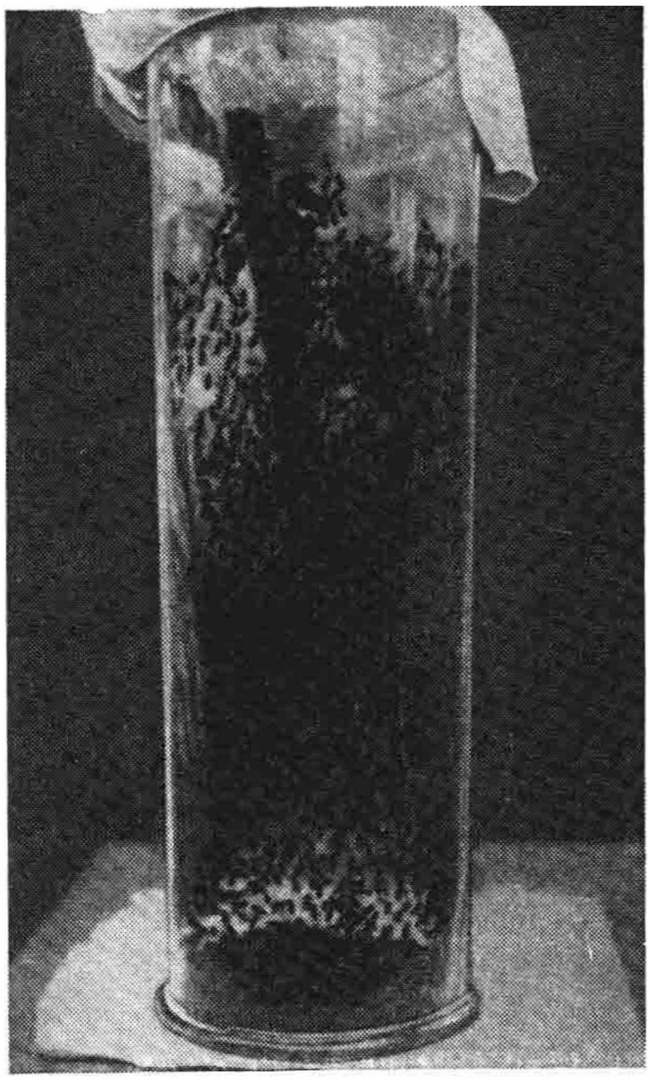

Fig. 18. Narcoticizing bees to obtain bee venom

Bearing all this in mind, we have constructed a portable device with which large amounts of venom can be obtained without harming the bees in any way. The device consists of a big cardboard box into which thousands of bees can be shaken from a frame. The captive bees can leave the dark box only through narrow passages so constructed that in passing every bee must excrete her venom. The drops of venom are left on special plates made of glass or celluloid but the stings are not torn and the bees, therefore, remain alive. After an interval of ten to fourteen days the same bees can be made to excrete venom again. Venom can be preserved for a considerable time without loss of its therapeutic activity. The worker-bees, from which venom is

taken, do not interrupt their main duties of collecting nectar, ripening honey, secreting wax, pollinating plants, etc.

The apitoxin preparation obtained in this way is in the form of crystals and can be posted to any part of the country. The quantity contained in a registered letter is sufficient to supply the medical institutions of a big city for a considerable time.

BEE VENOM IN HOMOEOPATHIC MEDICINE

The high medicinal properties of bee venom were first noted in 1847 by a homoeopath named Marci, who began to use it in his practice. Six years later, Hering another homoeopath, substantiated the use of bee venom in homoeopathy.

In 1861, the Russian *Medical Gazette* published an article by Gentske on the medicinal properties of bee venom. In lectures delivered at the Hahnemann Medical College of Philadelphia in 1875-85 E. A. Farrington said that *Apis,** a relatively new remedy, was an invaluable asset to pharmacology. Homoeopathy has been using bee venom under the name of *Apis* for more than a century and all textbooks on homoeopathy recommend it for a great variety of diseases.

Bee venom is one of the few homoeopathic remedies extensively studied by allopathy.

Numerous Soviet researches show that even homoeopathic doses of apitoxin are biologically effective. The experiments (they are described in more detail on page 147) show that the effectiveness of bee venom depends on the concentration of the solution. N. Artemov has established that a solution of bee venom in the proportion of one to 500,000 exerts a determined action on the isolated heart of a frog. Apitoxin is heat-resistant—it undergoes no change after ten days' heating at 100° C., and refrigeration

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* The correct designation is Apitoxin.

does not noticeably reduce its biological activity. Solutions of alkali and of sulphuric acid acting on apitoxin even for 24 hours fail to affect it in any way.

In spite of its heat-resistance and resistance to cold, acids and alkali, bee venom should not be taken perorally as it is decomposed by the gastric and intestinal enzymes. Our observations show, however, that homoeopathic doses of bee venom can be taken perorally, namely, sublingually when it is absorbed by the sublingual mucous membrane. The sugar tablet containing apitoxin must on no account be swallowed but held under the tongue until it melts completely.

The data we obtained when we checked the pharmacological action of homoeopathic *Apis*, used for more than a hundred years in the form of drops, granules and ointments, are of considerable interest. In homoeopathy granules are the most widespread form because they are convenient to take. The experiments the present author conducted jointly with Docent S. Buiko showed that in granules homoeopathic *Apis* even in a concentration of 1 to 10 produced an effect similar to that of pure sugar solution in distilled water of the same concentration. In our experiments the cardiograms of a frog's heart acted upon by a water solution of homoeopathic *Apis* granules and a water solution of sugar of the same concentration were similar. The cardiogram obtained by the action on a frog's heart of a water solution of pure apitoxin was entirely different. We think that this is due to the faulty preparation of granulated *Apis*, as some homoeopathic chemists prepare it not from pure bee venom but from overwintered dead bees whose intestines are by spring filled with faeces weighing nearly half of the weight of the bee itself. At present the clinics of some big cities, such as Moscow, Leningrad and Kharkov, are investigating the therapeutic activity of homoeopathic drugs.

We think that sublingual application of apitoxin in certain diseases will gain popularity in the near future.

Chapter V

CURATIVE PROPERTIES OF BEESWAX, PROPOLIS, POLLEN, AND ROYAL JELLY

BEESWAX

Beeswax is a very complex substance and its composition has not been exhaustively studied to this day. Altogether, wax is made up of about fifteen chemically independent components. It contains 70.4 to 74.7 per cent complex ethers of monoatomic alcohols (myricylic, cerilic and others) and fatty acids, 13.5 to 15 per cent free acids (cerotic, melyssilic, of the olein series, etc.), and from 12.5 to 15.5 per cent saturated hydrocarbons (pentacosane, heptacosane, nonacosane and others). In addition, beeswax contains dyes and aromatic substances to which it owes its colour and pleasant smell.

The remarkable properties of beeswax have been attracting man's attention since ancient times. It was widely used for sacrificial purposes in ancient Egypt. A papyrus dating from the reign of Ramses III (1204-1173 B.C.) mentions that the king donated a quantity of wax to the sacrificial fund.

For many centuries painters used wax paints, which were remarkable for their brilliance and durability, as we can see both from literary sources and from archaeological discoveries. The excavations at Pompeii and Herculaneum begun in 1706 uncovered wall paintings done with wax colours in the houses of rich Pompeians. Although these cities were covered by ash on August 24, 79

A.D., and had remained buried for nearly eighteen centuries, the beauty and brightness of the colours had not been impaired.

Nowadays, with new techniques taking the place of wax painting, beeswax still remains an essential part of oil colours.

Beeswax was widely used as a modelling and sculpturing medium.

Beginning with antiquity and up to the Middle Ages, writing tablets were made of wood and covered with a thin coat of wax on which characters were inscribed with a style—a metal stick with one end sharp and the other blunt, to make erasures by smoothing the wax. Pliny the Elder mentions pieces of canvas which were waxed and used as paper; Homer, the Roman poet Catullus, and many other ancient authors also mention this.

The Greek historian Herodotus said that "the Persians cover their dead with wax and then bury them."

That beeswax possesses preserving properties is confirmed by the anatomic preparations Peter I bought from the well-known Dutch anatomist Ruysch for the school at the first Russian hospital. At present they are kept at the Academy of Sciences of the U.S.S.R. The blood vessels and some tissues in these preparations were filled with coloured wax so that they could be more easily studied. In addition, the wax prevented the tissues from decaying.

The ancients attached great importance to the therapeutic activity of beeswax. Pliny wrote: "All kinds of beeswax soften, warm and also regenerate the human body, fresh wax being the most useful." Ancient Russian manuscript medical books point out that "wax mollifies all sores and used with sweet-violet oil eases the heart; it also cures boils and softens veins and wounds."

Popular medicine uses beeswax in the treatment of many diseases, especially lupus.

In this connection, mention should be made of the article "The Problem of Treating Lupus with a Popular

Remedy (Beeswax with Butter)" by D. Rapoport, scientific worker at the Byelorussian Institute of Dermatology and Venereal Diseases. In this article he wrote that the preparations used for local therapy of lupus have serious defects as they cause pain and yield unsatisfactory cosmetic results, leaving scars, etc. The ointment prepared from beeswax and butter does not contain any irritative substances and is effective in lupus.

Today, too, beeswax is widely used in medicine. The U.S.S.R. Pharmacopoeia requires all plasters, ointments and creams to be prepared with beeswax.

Here is a list of pharmaceutic preparations which cannot be made without wax: adhesive plaster (*Emplastrum adhaesivum extensum*), cantharis plaster (*Emplastrum cantharidum*), hydrargyrum plaster (*Emplastrum hydrargyri*), melilot plaster (*Emplastrum meliloti*), soap plaster (*Emplastrum saponatum*), camphor ointment (*Unguentum camphoratum*), cantharis ointment used in veterinary practice (*Unguentum cantharidis usu veterinario*), wax ointment (*Unguentum cereum*), spermaceti ointment (*Unguentum cetacei*), Goulard's cerate (*Unguentum plumbi subacetici*), zinc ointment (*Unguentum zinci*), cold cream (*Unguentum leniens*).

Beeswax is used in cosmetics for the preparation of nutritive, astringent, detergent and bleaching creams and face masks.

Detergent cream, for instance, contains 6 grammes of wax, 0.5 gramme of borax, 27.5 grammes of peach oil, 16 grammes of water. Nutritive cream contains 3 grammes of wax, 6 grammes of spermaceti, 24 grammes of peach oil, 4 grammes of glycerol. Cream for the greasy skin is made up of 5 grammes of wax, 5 grammes of liquid ammonia and 7.5 grammes of water. Nutritive masks are made up of 50 grammes of wax, 70 grammes of honey and some juice of the bulb of the white lily. Astringent masks are prepared from 10 grammes of wax, 10 grammes of peach oil, 10 grammes of lanoline, 50 grammes of paraffin, 0.5

gramme of zinc sulphate, 1 gramme of bismuth nitrate and 8 grammes of zinc oxide.

Professor K. Apinis suggests the use of the following formula for wrinkles: 30 grammes of white wax, 30 grammes of honey, 30 grammes of onion juice and 30 grammes of white lily juice. This is heated over a low fire in an earthen vessel until the wax melts, and stirred with a wooden stick until it cools. The resultant cream is applied to the face in the morning and evening and removed with a linen cloth. Professor Apinis holds that this cream not only prevents new wrinkles from appearing but also removes those already existing.

PROPOLIS*

Propolis or bee glue was used in medicine from ancient times up to the 19th century. Popular medicine holds it to be effective for malignant tumours and wounds. Propolis was widely used in the treatment of wounds in the Anglo-Boer War and military surgeons reported that it was very effective.

In 1909, N. Alexandrov published an article entitled "Propolis as a Drug" in which he described a method of treating corns he had used since 1893. A small piece of propolis is softened by heating, thinned to form a cake, applied to the corn and bandaged. A few days later the corn will fall out together with its root.

To this day propolis occupies a prominent place among popular remedies.

L. Khandros, Candidate of Chemistry, suggested the use of propolis during the Second World War, and it was tried in two surgical clinics of Sverdlovsk with good effect.

Recently, V. Kivalkina, Candidate of Veterinary Sciences, published the results of her experiments with propolis.

*From the Greek *pro*—before and *polis*—city, so named because in the natural state bees use propolis to diminish the entrance to their "wax city" and thus exclude intruders.

She discovered propolis to possess bactericidal properties against streptococci, staphylococci, Bacillus pyocyaneus, B. coli, B. typhosus, and some other micro-organisms.

She experimentally studied the influence of propolis on various species of bacteria (pathogenic, non-pathogenic, sporulating, non-sporulating, pigment-forming and non-pigment-forming). Tablets of a thickness of 3 to 5 millimetres were made from melted propolis and on them were deposited drops of 24-hour-old bacterial broth cultures. At different intervals passages were made on various culture media (meat-and-peptone broth, meat-and-peptone agar). The average results are shown in Table 9.

Table 9

(The + sign shows proliferation, the — sign—absence of proliferation, the +'— sign—inconstant results)

Culture	Time of cultivation							
	10 min.	20 min.	30 min.	1 hr.	2 hrs.	4 hrs.	8 hrs.	20 hrs.
Streptococcus	+	+	+	+—	—	—	—	—
Staphylococcus albus	+	+	+	+—	—	—	—	—
Staphylococcus aureus	+	+	+	+—	—	—	—	—
Bacillus pyocyaneus	+	+	+	+	+—	—	—	—
Bacterium prodigiosum	+	+	+	+	+—	—	—	—
Proteus vulgaris	+	+	+	+	+—	—	—	—
Bacillus coli	+	+	+	+	—	—	—	—
Bacillus typhosus	+	+	+	+	+	—	—	—
Gärtner bacillus	+	+	+	+	+	—	—	—
Bacillus of swine erysipelas	+	+	+	—	—	—	—	—
Anthraciod microbe	+	+	+	+	+	+	+	—
Pseudoanthrax	+	+	+	+	+	+	+	—

K. Gaptrakhimanova obtained very encouraging results in the propolis treatment of domestic animals affected with necrobacillosis. She arrived at the conclusion that the therapeutic effect of propolis ointment (prepared with paraffin, sunflower and henbane oils in the proportion of 1 : 1, 1.5 : 1) was the optimal as compared with other remedies.

N. Toporova and I. Toporina successfully applied propolis against necrobacillosis in cattle. The experiments were made on nine head of cattle affected with this epidemic disease, which causes necrosis of different tissues infected with Bacterium necrophorus. These experiments showed the effectiveness of propolis: on the seventh day after application of propolis ointment was started necrosis disappeared, granulation set in and the affected parts healed even without previous removal of the necrotic tissues. The ointment was made of propolis and paraffin oil taken in equal parts. From their experiments the authors made the following conclusion: "Propolis ointment is highly effective for necrobacillosis even in cases where the necrotic tissues are not removed or only removed from the surface. Its action is probably mildly irritating, and promotes the restoration of a normal trophic function."

As yet we do not know for certain what is the source from which bees produce propolis. It was believed for centuries that bees collect it from the buds of willows, poplars, birches, pines, firs, horse-chestnut, etc., but the results of recent investigations disprove this belief and indicate instead that bees produce propolis from pollen.

The chemical composition of propolis is as follows: about 55 per cent resins and balsams, about 10 per cent aromatic essential oils, nearly 30 per cent wax and 5 per cent pollen. In an experiment, vessels containing copaiba and Canada balsams, pine resin, rose oil and pieces of resin were hung on trees in a bee-garden; the bees were not observed to pay any attention to these substances, yet fresh propolis appeared in the hives.

When a hive is opened it is easy to see that with this greenish-brown sticky matter the bees attach the cloth inner cover to the upper bars of the frames, the frames to the hive walls and stop all holes and crevices. They also use propolis to polish the cells into which the queen lays eggs, and to envelop the bodies of bee enemies which are too heavy to carry outside, such as lizzards, mice, etc. That is why the air in the hive is always pure and no odour of decay is ever noticeable.

POLLEN

Scientists have long been interested in the composition of pollen and many attempts have been and are being made to find substitutes for it in the food of bees. The attempts to use rye, wheat, maize, oat and pea meals for this purpose have been unsuccessful and even such highly nutritive food-stuffs as eggs, whole milk and cream have failed to substitute pollen. What is pollen composed of? Some scientists think that pollen owes its nutritive properties to its high protein content, and indeed it is higher than in cereals. While rye grains contain 11 per cent proteins, rye pollen contains 40 per cent; the percentage of proteins in nut kernels is 11.6 and in hazelnut pollen 30. The value of pollen lies, however, not only in its high protein content, but also in the presence of many other important substances, first and foremost, of hormones, enzymes and vitamins.

Karl von Frisch says that pollen grains are the male sex cells of the flowering plants, corresponding to the spermatozoa of animals. Academician N. Tsitsin, too, considers pollen a product analogous to the products of sexual secretion of animals.

Experiments conducted at the U.S.S.R. Research Institute of Vitamins under the direction of V. Devyatnin, and also numerous experiments by foreign scientists, show pollen to be rich in vitamins. It contains vitamin E (toco-

pherol), B_1 (aneurin), B_2 (riboflavin), B_5 or PP (nicotinic acid), B_6 (pyridoxin), B_3 (pantothenic acid), B_c (folic acid), H (biotin), C (ascorbic acid), precursor of vitamin A (carotene) and P (rutin). The investigations made at the institute in 1955 showed pollen to contain 17 per cent of vitamin P—the factor increasing the impermeability of the capillaries. Pea-tree (*Caragana arborescens*) pollen contains up to 118.4 mg% of vitamin E, and sow-thistle pollen—170 mg% of the same vitamin; the mixture of cow-parsnip and Greek valerian pollens contains 16.6 mg% of carotene.

According to S. Lebedev's investigations pollen is an excellent source of carotene. He found pea-tree and lily pollen to contain 20 times as much carotene as red carrot, which is the chief source of the industrial production of that vitamin. The advantage of obtaining carotene from pollen lies in both greater concentration and the ease of the process: precursor of vitamin A can be extracted directly from pollen grains without any preliminary processing.

Vitamin B_1 (aneurin) is present in the following amounts in the pollen of different blossoms: apple—1 mg%, angelica—1.2 mg%, buckwheat—1.3 mg%, and pea-tree—1.5 mg%; the respective amounts of vitamin B_2 (riboflavin) are 1.8 mg%, 2.1 mg%, 1.6 mg% and 1.5 mg%. The pollen of goutweed contains as much as 2.3 mg% of riboflavin.

From the above figures it is clear that pollen is a concentrate of vitamins and it is therefore not strange that popular medicine attributes various medicinal properties to bee bread, i. e., pollen preserved in honey.

Academician Tsitsin is perfectly justified in saying that at present we can scarcely imagine how wide will be the use of biotic preparations which man will make from pollen in the near future. The time will come when thousands and millions of tons of pollen which is now lost to us will be used in the pharmaceutic industry.

ROYAL JELLY

Apidologists—students of bee-colony life and activity—have spent much time and energy on studying the anatomy and physiology of the worker-bee, the queen and the drone. They wanted to find out in particular why the queen emerging from the same egg as the worker and the drone differs from them in size, in anatomical structure and in physiological functions. They wanted to find an answer to the question why the queen is almost twice as long and heavy as the worker-bee, why she can lay an enormous number of eggs (2,000 and more within 24 hours) and why she can live nearly six years while her daughters—worker-bees—live for 30 to 35 days.

Long and careful observations showed that the egg from which bees want to hatch a queen is placed in a large acorn-shaped queen-cell where the conditions differ greatly from those in worker-size cells and where the larva (and this is of the utmost importance) is given a special kind of food known as royal jelly, a very nourishing product of a highly complex chemical composition.

Royal jelly is a pearly-white gelatinous mass containing (according to M. Haydak) 40.49 to 49.75 per cent proteins, from 7.59 to 15.18 per cent fats and 3.34 to 2.34 per cent mineral substances. On the average royal jelly contains 45.15 per cent proteins, 13.55 per cent fats and 20.39 per cent invert sugars (glucose and levulose); these figures are eloquent by themselves. In addition, royal jelly has been discovered to contain all known amino acids.

C. S. McClescy and R. M. Melampy have established that royal jelly possesses high bactericidal properties, exceeding even those of carbolic acid. This explains why dried royal jelly can keep long without spoiling.

In 1939, Henry L. Heyl found in it a gonadotropic hormone activating the sex glands. Experiments showed that five days after receiving a shot of royal-jelly extract subcutaneously the ovaries of female rats increased in weight

and their follicular activity was intensified. It was also established that the stimulating action of royal jelly is in direct proportion to its amount. The encouraging results obtained in experiments with insects (flies), fowl (chickens) and experimental animals (mice, rats, guinea-pigs) prompted physicians to try royal jelly as a remedy against certain diseases. Its outstanding therapeutic properties attracted the attention of researchers and physicians in Europe, the U.S.A., Canada, Mexico and other countries.

Royal jelly is being studied, tested and applied in many hospitals and medical institutions of France. The French Ministry of Public Health sanctioned tests of a liquid preparation of royal jelly in ampules for injecting intramuscularly with saline. The tests were carried out for two years at the Necker Hospital in Paris and in many cases brought about a recovery. After that the production of *Apiserum*, a preparation of royal jelly, was licensed.

In 1955, R. Willson reported the results of his experiments with applying royal jelly for the rehabilitation of weakened organs, for nervous diseases, for cardio-vascular insufficiency and some other diseases. At the Florida Cancer Institute the influence of royal-jelly treatment on malignant growths is being studied.

Moreaux, the French doctor who has made a preparation of royal jelly, bee honey and pollen, asserts that royal jelly possesses high prophylactic properties and that it is especially effective in preventing aging.

In addition to its therapeutic uses royal jelly is an excellent cosmetic, because it contains many substances favourably influencing the skin.

Researchers and physicians agree that owing to its high vitamin and hormone content, royal jelly must act favourably on the human organism. Its excessive use, however, may bring undesirable results, much as hypervitaminosis and even poisoning. It is well known that even a minute dose of vitamin D can cause poisoning, and the same ap-

plies to hormonal substances. That is why remedies including royal jelly can be administered only by experienced physicians well acquainted with the patient's constitution.

As yet only the first steps have been made in the study of the therapeutic and prophylactic properties of royal jelly; further experiments and clinical observations will help to reveal the secrets of this potent remedy and enable physicians to use it in the interests of public health.

BEES ENSURE HIGH CROPS

We know that bees play the most important role in the cross-pollination of agricultural crops.

For example, it has been observed that in the course of a definite period, the blossoms of an apple-tree were visited by 3 wasps, 22 beetles, 23 ants, 24 flies, 29 bumblebees and nearly 500 worker-bees. Pollination by bees increases the crops of buckwheat, sunflower and apples by 50 to 60 per cent, of melons and water-melons by 100 per cent and more, of fodder grasses, such as alfalfa, red clover, vetch, etc., three and four times over. By wisely directing the energy of worker-bees, the crops of peaches, tangerines and lemons can be increased four times, late cherries and early cherries seven times, and some varieties of grapes as much as ten times. The popular sayings about there being no orchard without a bee-garden and no fruits without bees are only too true.

Examples illustrating the high effect of bee pollination in agriculture can be given by the score. The Lenin Collective Farm of Anapa District, Krasnodar Region, for instance, was an exhibitor at the U.S.S.R. Agricultural Exhibition in 1954, because with its apiary of 700 colonies it had in 1953 increased its crop yield to the value of over 1,300,000 rubles. The sale of honey and wax brought the farm an additional income of 250,000 rubles. These figures are eloquent proof of the usefulness of bees, but bees as

pollinating agents bring about not only a quantitative gain—they improve the quality of the seeds and fruits. When the raspberries obtained through bee pollination at the Ukrainian Experimental Agriculture Station were compared with those produced by self-pollination, they were found to be much bigger and possess a better flavour.

Tea-plant seeds resulting from pollination by bees germinated twice as well as seeds set from self-pollination, and the plants that grew from the former were bigger and had larger leaves.

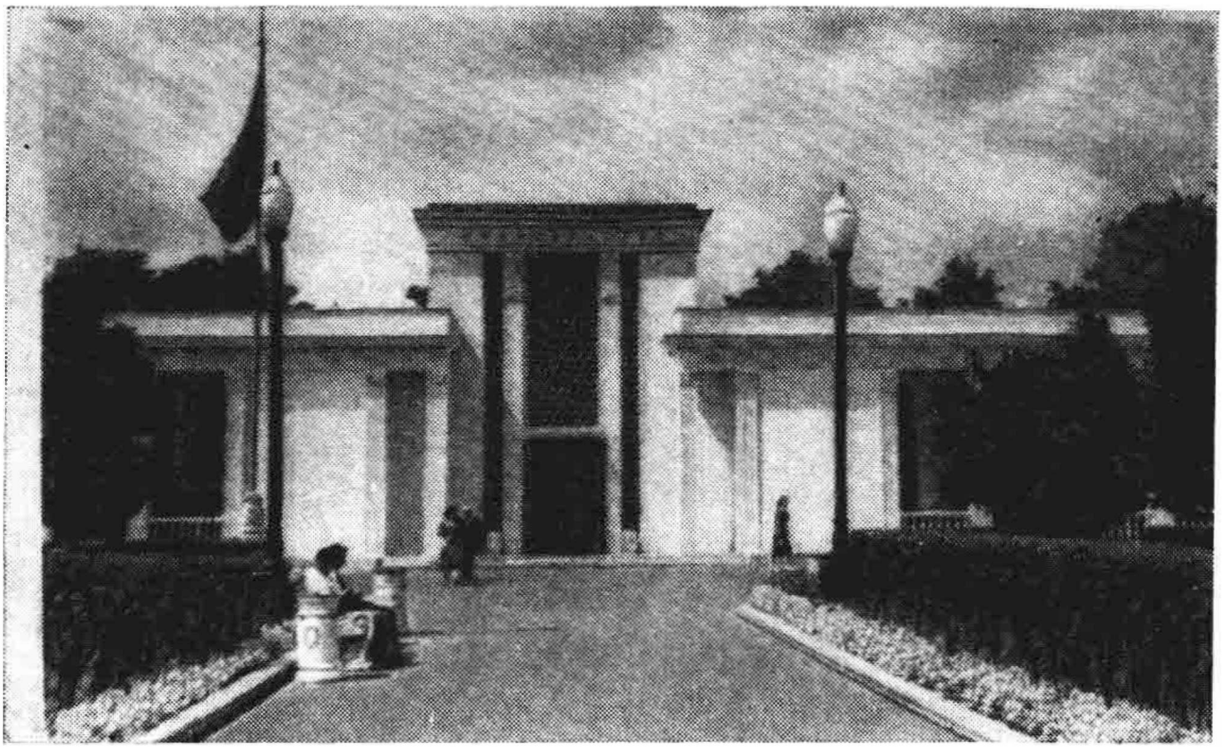
The observations conducted by S. Zhgenti, Candidate of Agricultural Sciences, showed that bee-pollinated fruits of Japanese persimmon ripened 30 to 40 days earlier and had 11 times as many seeds as self-pollinated ones. In the former case the fruits lost their astringent flavour and became dark-orange long before they were actually ripe, and their ascorbic-acid (vitamin C) content was higher.

We are inclined to explain this by the fact that when a bee settles on a flower her hard chitinous test and legs scratch it, and the plant with the "wounded" blossoms produces various defensive substances in its tissues, first and foremost, vitamin C. This may be another of the ways worker-bees benefit plants: in addition to providing them with enough pollen, i.e., bringing about a "marriage of love," bees slightly wound them, in response to which the plant cells produce vitamin C and substances stimulating the setting and development of fruit.

BEEKEEPING—A PROFITABLE OCCUPATION

Bees are kept in all parts of the Soviet Union and beekeeping has become an important branch of agriculture. Many collective farms derive large profits from their apiaries.

In 1946, the cash earnings per workday at farms in Dubrovka District, Krasnoyarsk Territory, were 2 rubles



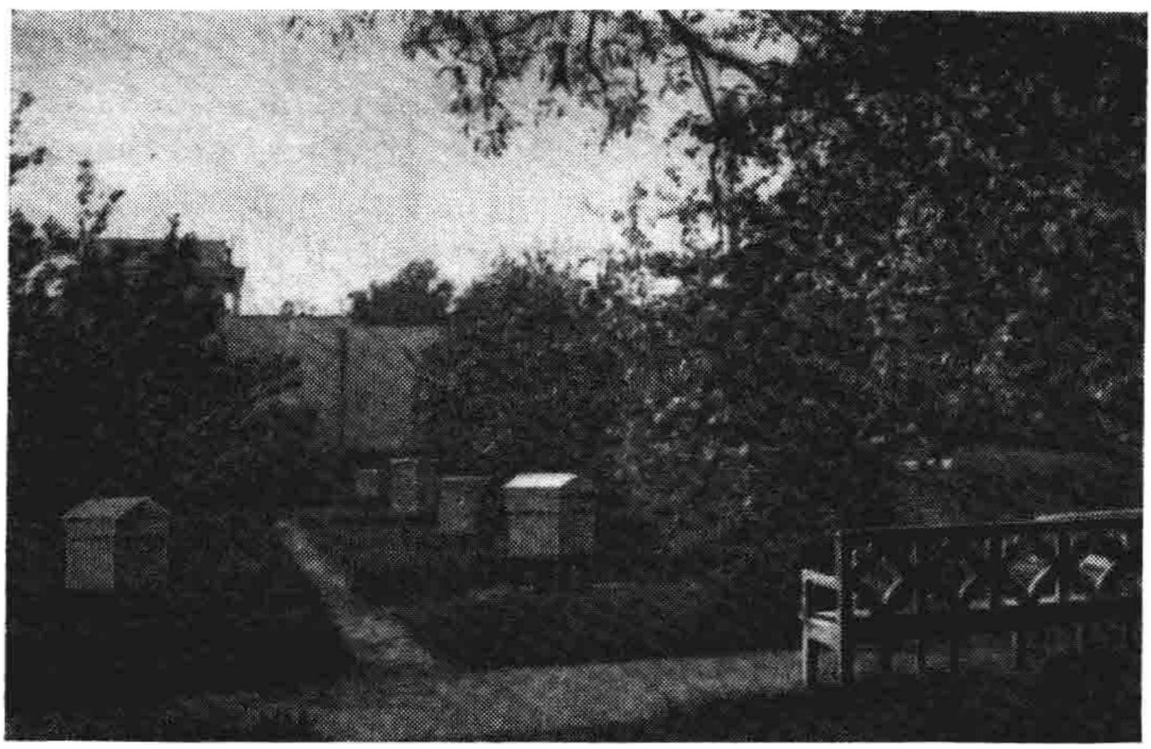


Fig. 19. a. *Apiculture* Pavilion of the U.S.S.R. Agricultural Exhibition. b. Bee-garden of the *Apiculture* Pavilion

35 kopeks from field husbandry, 3 rubles 85 kopeks from animal husbandry and 12 rubles from beekeeping.

Beekeeping brought the Fioletov Collective Farm, Stepanakert District, Azerbaijan S.S.R., a total of nearly 400,000 rubles in 1952.

In the summer of 1948 the Sanatorium of the Ministry of Public Health in Sochi received from its apiary 2 tons of honey and used it to improve the diet of its guests.

E. Rubtsov states that even in Zeya District in the north of Amur Region, with half of its territory lying in the area of eternal congelation, good crops are obtained (see Table 10).

Table 10

Year	Number of colonies	Net crop of honey in kg. per colony
1942	516	31.0
1946	1,384	44.0
1950	3,000	47.5

In addition to the number of colonies given above, there are in the district 1,000 colonies on the individual plots and in the bee-gardens owned by various organizations.

Beekeeping brings a profit to collective and state farms and supplies their members and workers with honey. At collective farms, beekeepers are entitled to extra payment in cash and in kind (honey). In 1947, forty-four beekeepers in Solton District, Altai Territory, received 4,661 kilogrammes of honey as extra payment for increased production.

G. Sokolov, the apiarist at the First of May Collective Farm, Orenburg Region, received 342 kilogrammes of honey as extra payment, and his assistant S. Yezhok—146 kilogrammes.

In 1950, beekeeping gave the Far East Collective Farm, Spassk District, Primorye Territory, an income of 170,000 rubles, i.e., 37 per cent of its total for that year. The members of the farm received 180 grammes of honey per workday unit.

An apiary of 115 colonies belonging to the Zhdanov Collective Farm, Moscow Region (apiarists A. Markachev and F. Korolev), yielded 6,323 kilogrammes of marketable honey in 1953. The high honey crop made it possible to give good stores of honey to the bees for the winter, to include honey in the payment in kind against workday units to the members, and to sell honey to the value of 28,801 rubles.

It is clear from the few examples we have given that beekeeping is a profitable branch of collective-farm economy, is advantageous to the beekeepers and to the entire population. Beekeeping at collective and state farms and by individuals has vast prospects before it.

APIARIES IN SCHOOL GARDENS

Many schools have their own experimental Michurin gardens, where pupils can study nature and make absorbing botanical and biological experiments.

The life of bees is an entrancing study. If children have a beehive in their garden they can study the life-cycle of the colony. They learn that worker-bees develop from fertilized eggs laid by the queen, that drones come from unfertilized eggs; they further learn when a fertilized egg produces a worker and when a queen, and many other things. By observing bees in a hive (especially, if it has glass walls) the children can study the influence of the environment—food, warmth, etc.—on the development of bees.

It is hard to describe how interesting such observations are, how much joy they bring to the observer. The life and work of bees are as fascinating as a fairy-tale.

Microscopic study of the parts of the bodies of worker-bees and drones, too, is very interesting. It is told of Peter I that when he was in Holland he was much interested in the microscope invented by Anton van Leeuwenhoek. Leeuwenhoek showed the tsar many curious things and Peter was astonished to see the barbs on the bee sting. Today every school has a microscope with much stronger lenses than Leeuwenhoek's and the pupils can see the simple and compound eyes of the bee, the proboscis, the honey-stomach, the Malpighian tubules, the sting, etc.

Vasily Tsis, school-teacher at the Novo-Yekaterinovka school in Staro-Beshevo District, Stalino Region, is one of an army of enthusiastic amateur beekeepers. In 1943, during the successful operations of the Soviet Army on the Dnieper, Tsis was a platoon commander. His courage and valour in that operation earned him the title of Hero of the Soviet Union. When the war ended he returned to his home village where he teaches at school and in his spare time looks after the bees in his garden and gives advice to the beekeepers of the collective farms in the neighbourhood. There are many nature-lovers among the 320 pupils of the school and Vasily Tsis often shows them what takes place in the hive and tells them about the life of the bee colony and the usefulness of bees.

School-teacher Trubin of the village of Pecherka, Pyshma District, Sverdlovsk Region, has a small bee-garden but from his four hives he obtains such high crops of honey that he is known throughout the district. His pupils often visit him in summer, watch him in his apiary, learn about bees and at the same time learn to love nature.

K. Gizatullin, teacher of biology at a secondary school in Kaibitsy District, Tatar A.S.S.R., organized a school society of beekeepers in 1947. Members of the circle often visit the collective-farm apiary, help the beekeepers in their work and learn much that is useful to them in their

studies of biology, of the teachings of Charles Darwin and Ivan Michurin.

In his *Fifty Hints to Beekeepers*, published more than a quarter of a century ago, V. Gorsky wrote: "Help the village school-teacher to set up a bee-garden, if he has no means of his own. At this apiary, the school children will learn about bees, and some may be so interested as to become in the future enlightened and cultured beekeepers."

In his recollections of Anton Chekhov, Maxim Gorky wrote: "Once he invited me to the village of Kuchuk-Koi where he had a small plot of land and a little white two-storeyed cottage. He showed me over his 'estate' and said excitedly: 'If I had a lot of money I would build a sanatorium for village school-teachers here. I would build a tall airy building with big windows and high ceilings. There would be an excellent library, all kinds of musical instruments, a *bee-garden* (my italics.—*N. Y.*), an orchard, a vegetable garden. . . . They could have lectures on agronomy, meteorology. A teacher must know everything, my friend, everything!' "

With the assistance of the U.S.S.R. Research Vitamin Institute and the Department of Public Education of Zheleznodorozhny District, Moscow, we have set up a museum of medicinal apiculture in Moscow which has an experimental apiary.

The aim of the museum is to demonstrate the role of bees and of products of apiculture in the life of man, to induce the population to keep more bees, to propagandize advanced methods of beekeeping and to teach how the products of beekeeping should be used to promote health.

The museum has on display reproductions of paintings by outstanding Russian classical and Soviet painters representing landscapes with apiaries, which blend so harmoniously with Russian scenery.

The exhibits on the stands—drawings, photographs, diagrams, etc.—deal with the nutritional and medicinal properties of honey. Here the visitors can watch bees in observation hives and learn about the "express" methods of obtaining vitamin and other medicinal kinds of honey. A small air-conditioned conservatory with space for flight enables school children to see bees at work all year round.

There are also models, photographs, drawings and diagrams dealing with methods of bee-venom treatment and illustrating cases when apitherapy is indicated or contra-indicated. Methods of extracting bee venom without killing the bees, too, are shown. Two stands are devoted to preparations, photographs and microphotographs of vitamins contained in natural and vitamin honeys with explanatory texts describing the importance of vitamins for man, and especially for children. A separate stand carries materials on pollen and bee-bread, on its chemical and biological composition. The theme "Bees and Medicine" given in its historical aspect from ancient times is treated in great detail. This problem includes not only the use in medicine of honey, beeswax and bee venom, but also beekeeping as an occupation for invalids, pensioners and so forth.

The Museum of Medicinal Apiculture runs a club of young lovers of medicinal apiculture, members of which (school children) take part in the museum's activities, carry out experiments and observations, collect herbariums of honey and medicinal plants of their native countryside, build their own models of observation hives, make beekeeping equipment, draw pictures featuring bees, etc.

There is no doubt that when the young beekeepers grow up to become doctors, agronomists, lawyers, journalists, tractor-drivers or skilled workers, they will continue to devote their free time to their early love—bees.

In the Soviet Union, young people are faced with the noble task of making the best use of the country's vast

food and medicinal resources. With the best of honey crops, we still collect not more than 10 to 20 per cent of the nectar our flora yields, the remaining 80 or 90 per cent being lost, for lack of bees to work it. If young people devote their energies whole-heartedly to the development of beekeeping so that the winged workers are plentiful in every part of the Soviet Union, we shall have an abundance of honey and beeswax, and the yields of fruits and berries, of fodder, essential-oil and industrial crops, as well as of other insect-pollinated plants, will be immeasurably greater.

BEEKEEPING AS AN OCCUPATION FOR INVALIDS

The Soviet Government shows its solicitude for war and work invalids by spending large sums annually on social insurance, but at the same time it provides suitable occupations for partially disabled persons who are still capable of working.

Soviet medicine considers living and working conditions very important and Soviet physicians determine whether a person is able or unable to work in definite, special conditions. This individual approach is patently manifest in the care and solicitude shown in the U.S.S.R. for invalids of World War II, hundreds of thousands of whom have been helped to return to work.

Beekeeping is a branch of agriculture open to many disabled persons who cannot be engaged in arduous physical work. The data at our disposal show that invalids of World War II do very well as beekeepers.

Here are a few examples.

V. Logashkov lost his right arm and leg during the war. After his discharge from hospital he entered the Agricultural Secondary School at Bitsa and upon graduation was sent to work as a beekeeper at the apiary of the Koptyazino Collective Farm, Shakhovskaya Dis-

trict, Moscow Region. He proved to be a clever and enterprising worker, able to overcome difficulties in his work, and the apiary prospers under his guidance.

The beekeeper at the apiary of the Udarnik Collective Farm of that same district is A. Solovyov, also a war invalid. The apiary yields large crops of honey and beekeepers from neighbouring apiaries often come to Solovyov for advice.

N. Bagurin, an agronomist-apiarist, works in Izhevsk, the capital of the Udmurt A.S.S.R., and has 50 collective-farm apiaries with a total of 2,406 colonies under his supervision. This young man lost his right arm in the war but his enthusiasm for work and for bees makes him overcome this serious obstacle. The apiaries under his supervision produce large amounts of honey.

A. Yarosh, beekeeper at the Uritsky Collective Farm, Rostov Region, is a war invalid; the average honey crop at his apiary is 150 kilogrammes per colony.

We could give the names of many more war invalids who work at collective-farm apiaries and obtain good harvests of honey.

Many invalids' producers' co-operatives have apiaries from which they receive good returns. The Poot co-operative society in Gorny Altai received from its 350 colonies 10,688 kg. of honey and 70 new swarms in 1948. The sale of honey and bees brought the co-operative 120,000 rubles. Many such examples could be given.

Vocational agricultural schools for invalids, functioning near Moscow and Leningrad, in Stalingrad, Kungur and many other towns, have apiculture departments.

Providing war invalids with jobs as beekeepers at collective-farm and other apiaries is an important concern of the state, because such work improves the well-being of the invalids and ultimately results in raising the harvests of agricultural crops and the production of such a valuable food as honey.

On February 26, 1945, the Soviet Government issued a decree "On Measures for the Development of Apiculture" providing for the sale of swarms by collective farms to collective farmers, workers, employees and, in the first place, to war invalids and to pensioners.

A promising beginning is the amalgamation of small apiaries owned by workers, employees, invalids and pensioners into beekeeping co-operatives. Such big apiaries can provide extensive pastures for their bees. In Krasnodar alone there are four such co-operative apiaries.

Work at the apiary can be recommended to invalids and pensioners as a means of improving their health.

MEDICINAL APIARIES

That health is strongly influenced by living and working conditions was realized long, long ago; Hippocrates noted this in his works. Soviet medicine quite rightly attaches great importance to this factor.

Outstanding Russian clinicists, such as M. Mudrov, S. Botkin, G. Zakharyin and A. Ostroumov, adhered to the principle that "it is not a disease but a diseased person who should be treated." More than 130 years ago, Dr. Mudrov taught his students that the work of physicians consisted in trying to cure the patient. In a speech delivered on December 7, 1886, Dr. Botkin said that medicine is the study of man and his environment. And Ivan Pavlov later said: "The late S. Botkin was a brilliant example of the rightful and fruitful union of medicine and physiology, the two branches of human activity which before our very eyes are erecting the edifice of the science about the human organism and promise in the future to ensure man his greatest happiness—health and life."

Z. Frenkel, Member of the U.S.S.R. Academy of Medical Sciences, says that "in the prophylaxis of aging the leading role belongs to the prevention of all diseases, especially infectious, rheumatic and intoxicative."

The numerous letters at our disposal written by persons over a hundred years old speak of the beneficial effects of work at the apiary. We have studied the answers to 390 questionnaires received from beekeepers of the

Ukraine, which we received mostly through the agency of district agronomist-apiarists, who certified to the correctness of these answers. Two hundred and seventy-eight questionnaires show that their authors had not been ill in the course of their work at the apiary. Twenty-two beekeepers stated that they had suffered from rheumatism but were cured of the disease by bee stings. The authors of the questionnaires who noted the beneficial effect of work with bees stated that they had not been ill of any disease during the following periods of time:

24 persons (including two who were cured of rheumatism) up to 5 years;

33 (including 4 cured of rheumatism) from 6 to 10 years;

30 (including 9 cured of rheumatism) from 11 to 15 years;

44 (including 5 cured of rheumatism) from 16 to 20 years;

41—from 21 to 25 years;

42 (including one cured of rheumatism) from 26 to 30 years;

18—from 31 to 35 years;

18 (including one cured of rheumatism) from 36 to 40 years;

11—from 41 to 45 years;

6—up to 50 years;

1—for 53 years;

1—for 57 years.

We see from these data that work in a bee-garden, i.e., in adequate environmental conditions, favourably influences health, increasing resistance to disease. Work in an orchard or in the forest, in the open air, makes man strong and healthy. The air, besides being pure, is filled with the scent of flowers, of honey and beeswax, and with the different balsams present in propolis. Everyone who has been in an apiary on a hot day knows how pleasant is the air there.

Our observations extended over many years have proved that people working in an apiary and eating honey enjoy good health and live to an old age, and we think that medical institutions should pay more attention to beekeeping. Hospitals, asylums, health resorts and holiday homes should have their own apiaries not only in order to provide their patients with honey; they should use the apiaries as a place of temporary work for their patients. For many of them work at an apiary will be both treatment and pleasant occupation. We have had occasion to observe nervous patients working at an apiary; the work proved an excellent sedative.

In 1949, I received a kind letter from Safar Husseinogly, a 138-year-old collective farmer from the village of Morul, Shimkhorsk District, Azerbaijan S.S.R. He wrote that he attributed his longevity to honey and work at an apiary in the open air.

It is always a pleasure to do the work one likes. And beekeepers are noted for loving their work, and, besides, they have wonderful creatures to deal with.

Beekeeping is attractive not only because it brings big profits from the sale of its products and from cross-pollination, but also because it is a great pleasure to watch the life of bees. Among the great naturalists who studied bee life were Aristotle, Darwin, Réaumur, Pyotr Rychkov, Afanasi Kaverznev, Charles Rouillé, Pyotr Prokopovich, Ivan Michurin and Academician N. Kulagin. Many scientists and specialists in the field of technology and art could be named who, once they made their acquaintance with bees, became their staunch friends for life.

The time is undoubtedly ripe for establishing medicinal beekeeping, for utilizing all the products of apiculture for medicinal purposes. Physicians must be more enterprising in using bees and products of beekeeping for therapeutic and preventive purposes. They should advise some of their patients, especially invalids and people in retirement, to

keep bees and take treatment at nature's own clinic—the apiary.

We think that medical institutions should pay more attention to beekeeping as work for invalids and set up their own apiaries where they could obtain vitamin and medicinal honey by the "express" method and use on a wider scale honey and bee venom in their practical work.

CONCLUSION

Mikhail Kalinin once said that the people are like prospectors for gold or diamonds, choosing, preserving, carrying and polishing over many decades only what is truly valuable, truly beautiful.

Indeed, in the course of centuries people found medicines in nature, but many of these medicines did not withstand the test of time and were forgotten. Honey and bee venom, however, continue to enjoy a great and well-earned reputation as an excellent medicine against many diseases.

The outstanding medicinal properties of bee honey and venom have been established not only through the experience of popular medicine. They are confirmed by research and clinical data. Thousands of people who had suffered from different diseases owe their recovery to treatment with bee honey or venom.

Honey is almost unique in that it combines excellent nutritive and medicinal properties. From the times of Hippocrates, honey has been valued as a food and medicine; ancient Russian manuscript medical books speak highly of it as a remedy.

Today honey, widely used in popular medicine, is taking its place in the clinic.

Honey is successfully applied in the treatment of both adults and children and is one of the very few medicines which everybody takes with pleasure.

The "express" method enables hospitals and pediatric health institutions to use honeys of different composition.

Bee venom, too, is a favourite drug of popular medicine. Apitoxin acts on the whole body and this may explain its use for very numerous diseases.

Throughout this book we have been anxious to show the high therapeutic activity of honey and bee venom. We do not consider them effective for *all* diseases, but we are convinced that under the direction of physicians broad application of these remedies will snatch hundreds and thousands of human lives from the clutches of death.

To the Reader

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